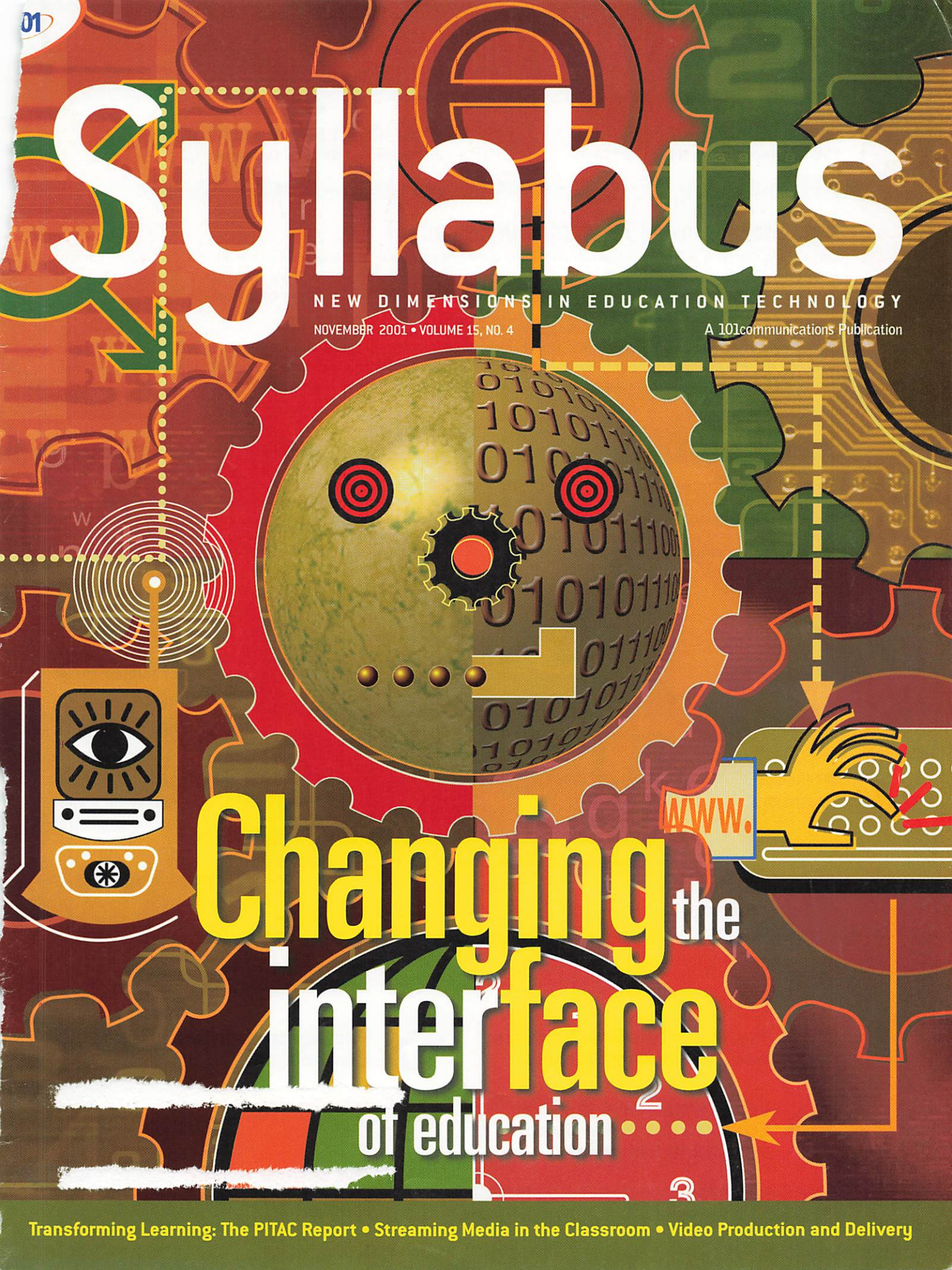
Syllabus

NEW DIMENSIONS IN EDUCATION TECHNOLOGY

NOVEMBER 2001 • VOLUME 15, NO. 4

A 101communications Publication



Changing the interface of education

Transforming Learning: The PITAC Report • Streaming Media in the Classroom • Video Production and Delivery

fall2001 Boston Area Education Technology Conference & Exhibition

Main conference
Thursday and Friday, November 29-30

Post-conference workshops
Saturday and Sunday, December 1-2

Next Steps: Moving Forward with Campus IT

Once again, Syllabus will bring leaders in education technology together in the Boston area in the fall. This year's conference examines the central themes and key technologies that have become increasingly important to diverse constituent groups in higher education as they move forward together with strategic technology planning and innovation.

Syllabus fall2001 is a conference for faculty, administrators, and IT professionals who want to explore the latest applications of information technology in higher education institutions. It provides a collegial environment in which attendees can exchange experiences with campus IT, encounter exemplary implementations of new technologies for teaching and administration, and discover how new media are best integrated into the teaching and learning process.

Conference Features

The need for coordination among stakeholders in the technology decision-making process – faculty, IT, and administrators – is acknowledged and facilitated through various session formats and presentation types, along with ample opportunities for networking and peer interaction.

The wide variety of conference activities and session types offered at the conference will provide attendees with exposure to experts and visionaries, a chance to see case studies by teaching faculty and technology staff, and time to meet with attendees from other institutions, both informally and in structured sessions.

Keynotes

Featured panel

Exhibits

Technology classrooms

Breakout sessions

Featured track

Poster sessions

Post-conference workshops and seminars

Tracks

1. **New Technologies Update**
2. **Technology Infrastructure and IT Planning Issues**
3. **Web-Based and Online Environments for Teaching and Administration**
4. **Evaluation and Assessment Strategies**
5. **Faculty Innovation: Case Studies**
6. **New TLT Track**
   Owning, Sharing, or Stealing Online? Testing the Digital Realm

www.syllabus.com

November 29-December 2, 2001
Sheraton Ferncroft Resort • Danvers, Mass.

Syllabus

Keynote Speakers

Thursday, November 29

Carl Berger
University of Michigan-Ann Arbor

The Next Killer App, or... So You Thought Your Change in Administrative Computing Was Expensive...

Carl Berger, Ed.D., is currently Professor of Science and Technology Education and Director of Advanced Academic Technologies in CARAT (The Collaboratory for Advanced Research and Academic Technologies), Office of the Provost, at University of Michigan-Ann Arbor.

Friday, November 30

Kathy Christoph
University of Wisconsin-Madison

Targeting the Transformation of Teaching and Learning Through Technology

Kathy Christoph is Director of Academic Technology Solutions at the University of Wisconsin-Madison, Division of Information Technology. She is also Assistant Provost/Vice Chancellor.

Featured Panel

Friday, November 30

Open Source Software: A Sustainable Model for the Next Generation of the Internet?

Phillip D. Long, Ph.D. *(moderator), is a Senior Strategist for the Academic Computing Enterprise at MIT*

Henry Schaffer *is the Coordinator of Special IT Projects and Professor of Genetics and Biomathematics at North Carolina State University*

Christopher Etesse *is Director of Technology and Commerce at Blackboard Inc.*

Fees and Registration

Conference Fees

❑ **Thursday/Friday conference only** **$465**
(Includes breaks, lunch, and materials)

❑ **1 full-day hands-on workshop or seminar only** **$265**
(Includes breaks, lunch, and materials)

❑ **1/2 day hands-on workshop or seminar only** **$205**
(Includes breaks and materials)

Note: A complete listing of workshops and seminars is posted on SyllabusWeb (**www.syllabus.com**)

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❑ **Silver Passport (a savings of $155)** **$575**
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(Must submit as a group from a single institution to qualify)

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EDITOR'S NOTE

Mary Grush, Editor

Innovations in instructional technology—we've all seen them—virtual learning environments, streaming audio and video lectures, and multimedia course materials, to name just a few—are presenting new possibilities both in the classroom and online. They are supporting new learning modalities and somehow causing great changes in the management of education. But are these changes *fundamental?* Are we truly transforming learning?

Our first two feature articles examine the nature of change in education technology from somewhat different perspectives. In "Changing the Interface of Education with Revolutionary Learning Technologies," (p. 10) MIT's Nishikant Sonwalkar takes a look at the relationship of technology interfaces to learning styles and suggests that the multimodal approaches enabled by new technologies foster a more student-centered environment. And in "Transforming Learning: Reflections on the PITAC Report," (p.14) Judith Boettcher, of CREN, explores the right questions to ask as we move forward to design future education systems. Both of these articles gently support the notion that we aren't there yet—basic research is need in the learning sciences to determine the best uses of information technology for teaching and learning; and studies on large-scale deployment and infrastucture issues are necessary for general success.

Syllabusfall2001 is coming up soon—November 29-December 2—to be held again this year at the Sheraton Ferncroft in Danvers, Mass., just outside of Boston. Please see the basic conference information on the inside front cover of this issue and join us at this dynamic event. The full conference program and an online registration form can be found on the Web at www.syllabus.com/fall2001.

Have you considered presenting your work with technology at a Syllabus conference? If you are not presenting in Boston, the next opportunity to present will be at our ninth annual summer conference in Santa Clara, California. Syllabus2002 will be held at the Santa Clara Convention Center, July 27-31, 2002. We're planning a diverse program with extensive track offerings. There's still time to respond to the Call for Papers posted on SyllabusWeb and reprinted on page 26 of this issue…simply submit your proposal online.

Enjoy this issue of *Syllabus*!

Mary Grush

Letters to the editor should be addressed to the editor and sent to 101 First Street, #605, Los Altos, CA 94022 or via electronic mail. We reserve the right to edit all submissions. **News and product information** will be considered for publication. Please send all materials to Paul McCloskey. If you are interested in writing for *Syllabus*, please send a brief description of your article idea along with writing samples to the editor at the above address.

Syllabus
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Vol. 15, No. 4 Syllabus Press

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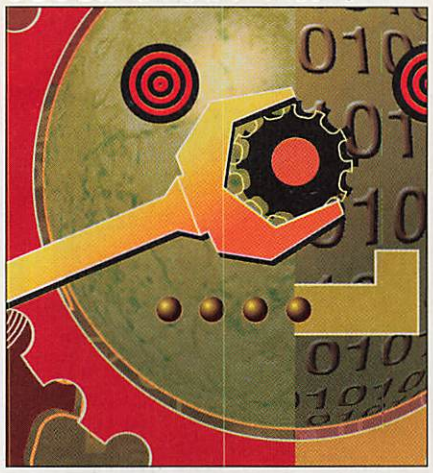

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Web-based or Web-supported courses, high-quality video streamed over the Internet, virtual learning environments, and voice recognition are just a few of the technologies that will foster fundamental changes in the interface to educational resources and systems.

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Phillip D. Long

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TRENDS

AN INFORMATION RESOURCE OF INTEREST TO EDUCATORS

Briefs

■ The **Wharton School of the University of Pennsylvania** announced the creation of the $10 million Alfred West Jr. Learning Lab, a development center and laboratory to produce learning tools and technology-enhanced course materials. ■ The **University of Alabama at Birmingham** is running a pilot program to test the use of digital certificates to secure transactions involving its faculty, staff, and students. The pilot will test applications including human resources, grants administration, and access control. ■ Silicon Valley's **De Anza College** has teamed up with a local software company, **ImpactXoft Inc.** to fund a new course in "simultaneous product development." Web-centric digital modeling software will allow dispersed teams to collaborate. ■ A **Michigan Economic Development Corporation** study shows the majority of technically educated Michigan university students remain in the state after graduation. Michigan retained 79 percent of graduates in the life sciences, information technology, and engineering sectors.

For these and other news stories, or to subscribe to the weekly Syllabus e-News, Resources, and Trends, visit www.syllabus.com.

Everything is Different Today

Everything has changed. What was once an over-inflated claim by technology companies seeking to have their message stand out from the crowd has become—in one day—a truth for us all. In the aftermath of the terrorist attack on the World Trade Center and the Pentagon, what once seemed important now has a vastly different perspective. Whether you live near the epicenters of the tragedies or thousands of miles distant, this will affect you. One immediate impact of the disaster is on travel.

I was supposed to give a talk to the Distance Education Workshop 2001 held at North Carolina State University (NCSU) on Thursday and Friday, Sept. 13-14. As of Sept. 11, that was no longer possible. Logan airport was closed. I sent my regrets and tried to assimilate the breaking news as best I could. On Wednesday evening I got an e-mail asking if I could do the presentation over H.323, that is, with video over IP. Over the next 24 hours I looked to see if a suitable origination site was available, while the conference organizers looked for portable video conference equipment for the presentation room. On Friday morning we established the connection and I gave the talk. An added bonus of remaining in Boston was that I was able to have a colleague join me at my end, making the presentation much richer. A Q&A followed, moderated by a colleague at NCSU.

I suspect that the terrorist attacks are a harbinger of one new aspect of our future. While face-to-face (f2f) interaction offers the ultimate bandwidth for communication between people, it presumes that the effort to bring people together is affordable. Today that effort and expense has dramatically risen.

But video over IP isn't the only communications alternative that will receive renewed attention. A suite of virtual classroom software has emerged with features that include an integrated whiteboard, live application sharing, content archives, streaming audio and video, audio bridging, and integrated polling or survey tools. The productivity benefits of these features become rapidly apparent considering the ability to get together on the phone in an audio conference, or call in to a voice bridge while simultaneously viewing materials under discussion on a PC and maintaining a side channel of chat or near synchronous message exchange.

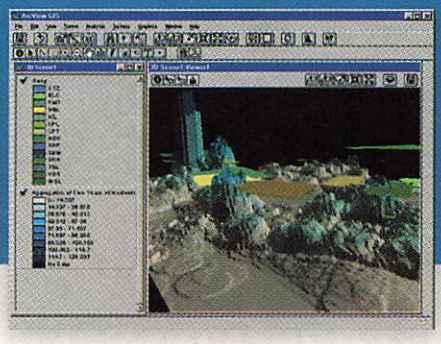
H.323 - Video over IP

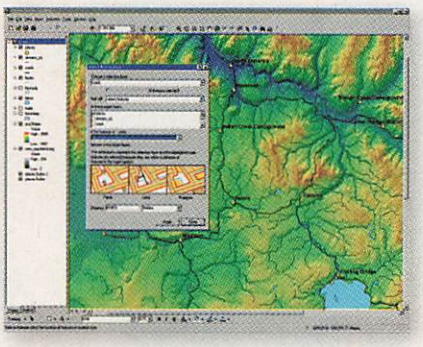
H.323 is a standard that specifies the components, protocols, and procedures that provide multimedia services—real-time audio, video, and data communications—over packet networks, including Internet protocol (IP)-based networks. H.323 os a part of a family of protocols called H.32X that covers multimedia communication services over a variety of networks. For a tutorial on H323, see the International Engineering Consortium site: www.iec.org/online/tutorials/h323.

One of the more effective examples of this technology is *TechTalks*—live bimonthly audio Web casts on topics relevant to networking and information technology featuring leaders in higher education IT. TechTalks are sponsored by CREN, the Corporation for Research and Educational Networking (www.cren.net). These free Web casts will give you a sense of how this combination of tools works.

With the attacks, the use of technology to bridge distance has gained added importance. September 11th has changed everything, including how we perceive technology's power to bring us together. We are reminded of how ephemeral are the things we once thought of as permanent in our world. Now take a moment and reach out to those you care about, even if the touch is electronic.

Are Your Graduates Problem Solvers?





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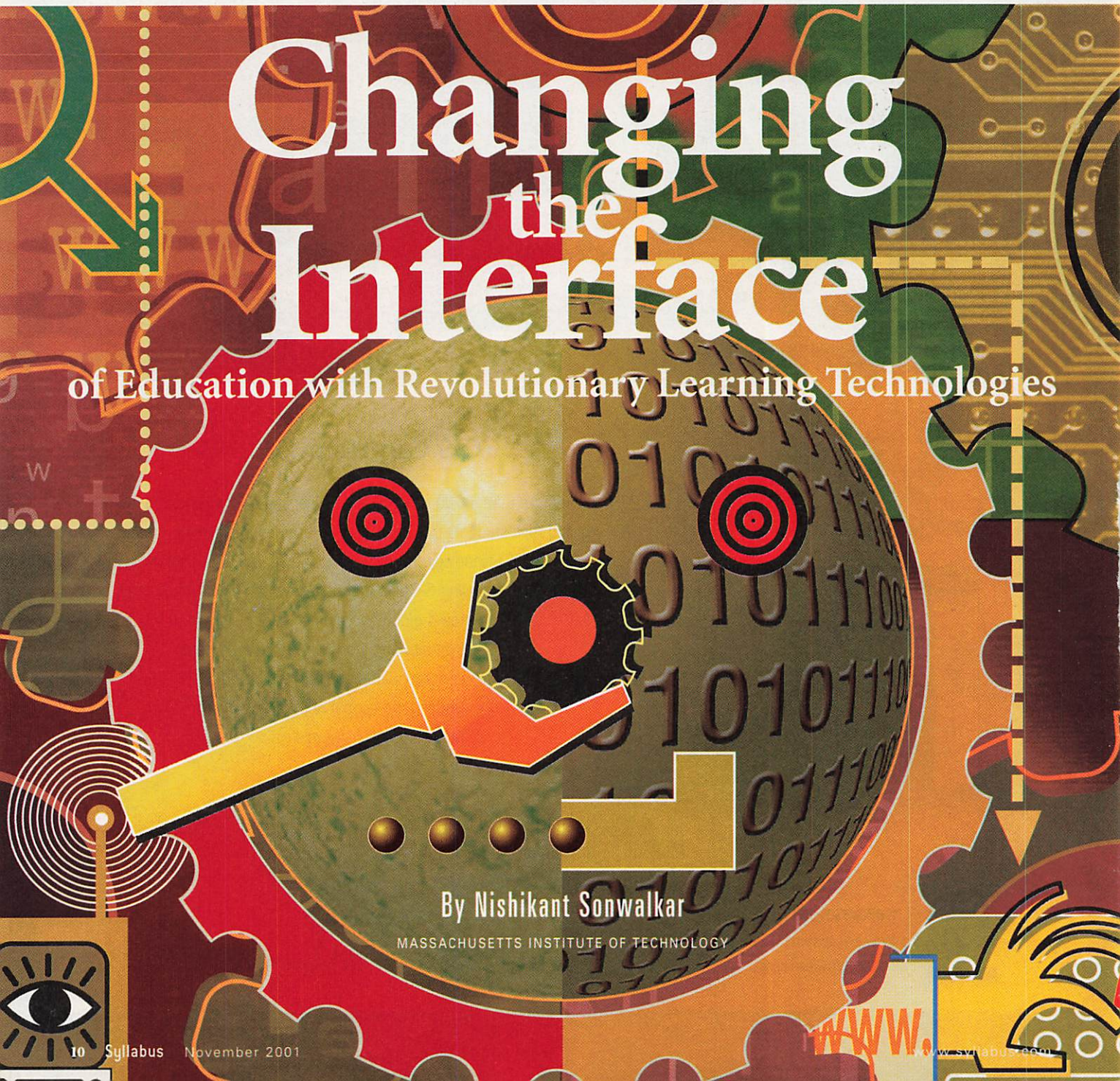
Technologies such as streaming video, virtual learning environments, and teleoperated experiments are entering the Web-based learning arena. Along with the development of a second-generation online education infrastructure, it will be necessary to consider changing the interface of education—reinventing pedagogy for the new interface,

Changing the Interface

of Education with Revolutionary Learning Technologies



By Nishikant Sonwalkar

MASSACHUSETTS INSTITUTE OF TECHNOLOGY

including multimedia and hypermedia enhancements, and creating the educational standards necessary for generalized deployment. Here, Nishikant Sonwalkar provides an overview of key issues that we hope will spark a discussion among the various stakeholders in the development of online learning systems.

An undeniable shift is taking place now from classroom teaching and learning to asynchronous Web-based and Web-supported learning environments. The dissemination of educational content is surely moving from a teacher-to-student model to a technology-enabled interface. As our roles evolve from "sage on the stage" to "guide on the side," this shift will be evident in the modes of technology that support the educational interface.

Many of these mode changes have already taken place. Simple interfaces, such as Internet browsers, are now providing the glue to connect students to teachers and to self-paced online courses. Advances in voice and pattern recognition technologies will soon enable more natural interfaces. And widespread use of wireless personal digital assistants (PDAs) and embedded screens in cellular phones will enhance both communication and interaction.

The increase in the power of personal computers is leading the way toward virtual reality learning environments. Technologies such as head mounted displays (HMD) and data gloves are interfaces for immersive, partially immersive, and enhanced reality environments.

Learning Mode Shifts

Synchronous	Asynchronous
Passive	Interactive
Television	Desktop computers
Keyboard	Handwriting recognition systems
Mouse	Data glove
Touch screen	Voice recognition systems
Real experiments	Virtual experiments
Real educational space	Virtual reality learning environments (VRLE)
Experiments in labs	Teleoperated experiments from remote locations

Reinventing Pedagogy

From studies in brain surgery, cognitive science, psychology, linguistics, and artificial intelligence, theories have emerged about the capacity of the human brain to learn. In answering the fundamental question of how we learn, we look to the basic modes of cognition—touch, smell, sound, vision, and taste—and to the primary educational modes of listening comprehension, ocular comprehension, and haptic comprehension. Cognition is a complex process that results from multimodal perception, and research has shown that cognitive competence presents itself differently in individual learners.

Of the numerous pedagogical models proposed in education science literature, those developed for online distance education do not take full advantage of the online medium. In attempting to harness the capabilities of digital interfaces, the mistake is often made of recreating a classroom-teaching model within an online learning environment. Online technology designed to mimic the classroom becomes a restriction and a barrier to the teacher's ability to impart knowledge.

A fundamental paradigm shift is necessary to create a pedagogical model with the asynchronous technological interface in mind. The pedagogy must allow for flexibility, interactivity, and media-rich and adaptive environments that both provide indi-

The Five Fundamental Learning Styles for Online Asynchronous Instruction

Apprenticeship
A "building block" approach for presenting concepts in a step-by-step procedural learning style.

Incidental
Based on "events" that trigger the learning experience. Learners begin with an event that introduces a concept and provokes questions.

Inductive
Learners are first introduced to a concept or a target principle using specific examples that pertain to a broader topic area.

Deductive
Based on stimulating the discernment of trends through the presentation of simulations, graphs, charts, or other data.

Discovery
An inquiry method of learning in which students learn by doing, testing the boundaries of their own knowledge.

Illustration by Lollabek.com

vidualized learning and are also accessible to large numbers of learners for collaborations and group discussions. This learning environment must allow multiple modes of cognition.

Hypermedia-based education systems are flexible, with multiple pathways for cognition and learning. Multimedia enhancements and hypermedia-based instruction will possess the flexibility required by digital interfaces. In hypermedia-based systems, multimedia objects in the form of audio clips for graphical objects, annotated video segments, and online simulations are presented with an associated database of concepts. The modes of learning change from textual to audio, and audio to video, and so forth, as the learner invokes the multimedia objects merely by clicking on links. This provides the flexibility to acquire knowledge from different modes, e.g., auditory, visual, and kinesthetic. Web browsers are networked hypermedia interfaces that allow such flexible, multimodal explorations for a given subject matter.

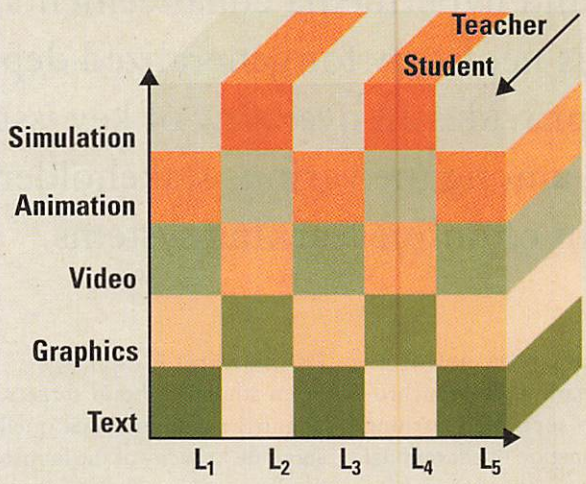
There is an acute need to define a framework for the educational models that will provide a basis for the implementation of online education. The basis of learning starts with cognitive pathways, which we use to acquire and assimilate information. These cognitive pathways refer to the sensory perceptions of the human mind and include vision, hearing, touch, smell, and taste.

The sensory organs provide the necessary stimulus for infants to assimilate information and the human brain to assimilate knowledge. With the development of language skills, higher order learning becomes possible. The cognitive pathways then become text, graphics, audio, video, animation, and simulations. These cognitive pathways to the human brain predominantly utilize vision and hearing; however, in a simulated environment it is also possible to use haptic interfaces as a means of knowledge acquisition.

There are several learning models that can be used for online asynchronous learning, including apprenticeship, incidental, inductive, deductive, and discovery. Each model offers a unique way to represent content. Access to each of the models enables the learner to master the content more readily.

The combination of media and pedagogically inspired learning styles can be represented as a cube (Figure 1) where the media—text, graphics, audio, video, animation, and simulation—are ordered from simple to complex, and the cognitive-based learning styles—apprenticeship, incidental, inductive, deductive, and discovery—also scale by learner involvement. The third axis describes the paradigm shift from a teacher-centric to a learner-centric modality of learning.

Figure 1: The pedagogical learning cube



L_1=Apprenticeship
L_2=Incidental
L_3=Inductive
L_4=Deductive
L_5=Discovery

Multimedia Enhancements

Recent developments in digital imaging, streaming audio and video, and interactive human-machine interfaces provide a wealth of opportunities to enhance the learning experience. More important than the technologies, however, is the context in which the multimedia enhancements are presented to learners. The design and development of combined media components—text, graphics, audio, video, animation, and simulations—for enhancing the learning process will depend on the learning model appropriate for the delivery of given course content. A list of a few potential multimedia enhancements might include:

- **Audio annotations to graphics**
- **Graphical visualization**
- **Audio annotations to video demonstrations**
- **Video demonstration of graphical elements**
- **Animated graphical frames (animated gifs)**
- **Audio annotations for animated graphics**
- **Animation of physical concepts**
- **Text annotations to video frames**
- **Animated simulations**
- **Numerical simulations for parametric studies**
- **Graphical simulation of mathematical equations**

Video, animations, and simulations offer exceptional potential for enhancing the interface of education. Experimental demonstrations and real-life experiences and situations can be captured on video and provided as digital video.

Video can be a window to the real world for a given theoretical description. In the past, there were considerable bandwidth, cost, and quality issues associated with video enhancements. However, with the development of video compression and real-time video streaming technology, many of these barriers have been overcome, and the potential for significantly increased bandwidth is real.

Animations are an inexpensive alternative to the video demonstration. The animations of physical phenomena or a difficult concept can bring the point home much more effec-

tively than video clips can. However, animations are not substitutes for video demonstrations.

Simulations can provide a risk-free environment for understanding the consequences of parametric variations and can be considered "hands-on experience" in place of real situations. For example, flight simulators are used to train fighter pilots, and dangerous or expensive laboratory experiments can be conducted without risk, and at a lower cost. The environments created by numerical and animated simulation provide a unique opportunity to learn while increasing the retention of the concepts.

Standards for Educational Media

In the past decade there have been several proposals for creating a uniform standard that will provide a basis for universal use, reuse, and sharing of learning objects. Since the adaptation of models used in library science to categorize content objects (the Dublin Core), there has been a movement to create metadata and standards for shared media—this includes Instructional Management Systems (IMS) metadata standards, IEEE 1484 metadata and database standards, extensible markup language (XML), educational markup language (EML), database structures for educational components (Aviation Industry CBT Committee-Computer Managed Instruction), and a sharable courseware object reference model (SCORM). These standards and markup languages will potentially provide the means to define course structure, objects, and hierarchy.

The goal of standards for educational media is to provide a taxonomy, methodology, and object structure that will coordinate the development of online educational courses. Most of these standards are in the evolutionary stage and the winner in the race to be the *de facto* standard remains unclear.

Toward a Fundamental Change

The paradigm shift in the pedagogical design of online education will require much more in-depth study and analysis of existing methods and evolving technologies. Clearly, education delivery is not simply information transfer. There is much to learn, but we already know much about the potential of the technology for multimodal delivery of learning material to a variety of online learners.

Nishikant Sonwalkar is the principal educational architect at the Educational Media Creation Center at the Massachusetts Institute of Technology, and serves as the pedagogical advisor to Web-based educational experiments and projects. ***nish@mit.edu***

NOTE

In the coming months, *Syllabus* will follow up on the ideas presented in this article with a series of explorations of the key technologies and applications that will affect fundamental changes in the design, development, and deployment of online education. Join the discussion by e-mailing your ideas and comments to Nishikant Sonwalkar (nish@mit.edu) or to the editors at *Syllabus*.

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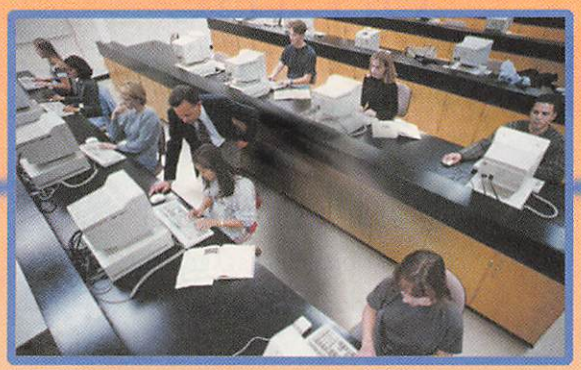

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Transforming Learning: Reflections on the PITAC Report

By Judith V. Boettcher

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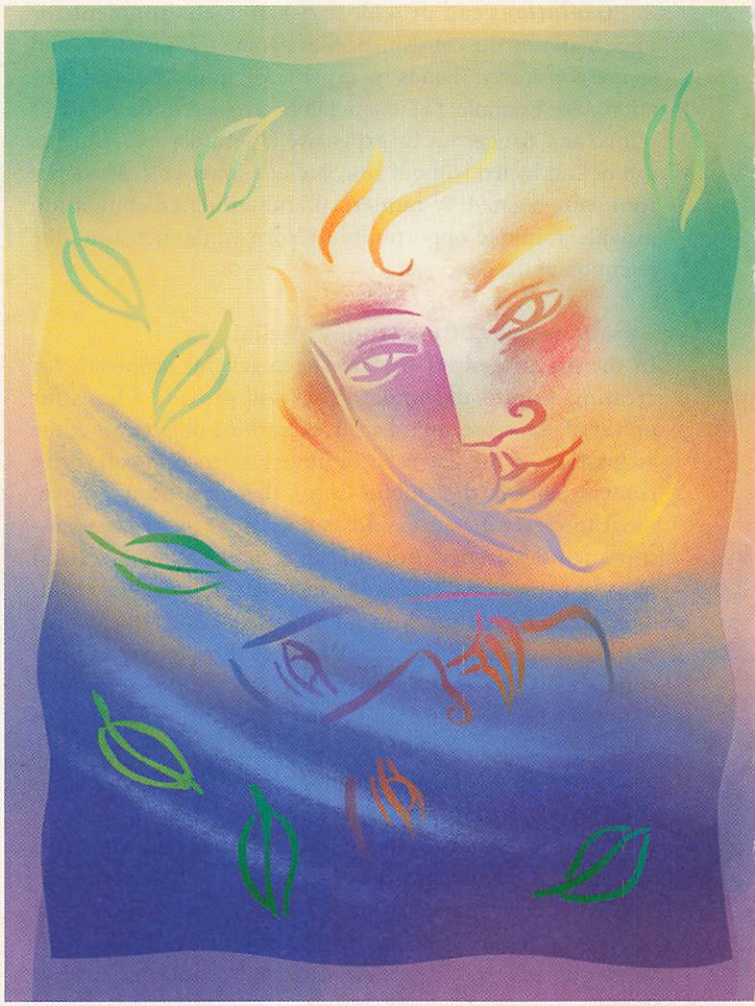


How can we use information technology to foster fundamental change in higher education? We asked Judith Boettcher to reflect on the President's Information Technology/Advisory Committee (PITAC) 2001 report.

The challenge of re-designing our educational systems is so overwhelming that most of us don't know what we personally can do to support this transformation. Thanks to our ideals of Jeffersonian democracy, the need for providing for an informed citizenry is not questioned. But national initiatives to transform, build, and update our educational systems seem to be stalled.

I hope that a recent report, "Using Information Technology to Transform the Way We Learn," (2001) authored by a select panel on Transforming Learning from the President's Information Technology/Advisory Committee (PITAC) gets significant attention. The Transforming Learning report lays out a set of recommendations that support the transformation of education at all levels while addressing the key elements of the education equation: tools, systems, processes, learners, and teachers.

What we need now is a national initiative to begin acting on these recommendations. Given the widely distributed nature of our educational systems, we will also need a groundswell of support for IT initiatives, including significantly increased resources dedicated to research and development.

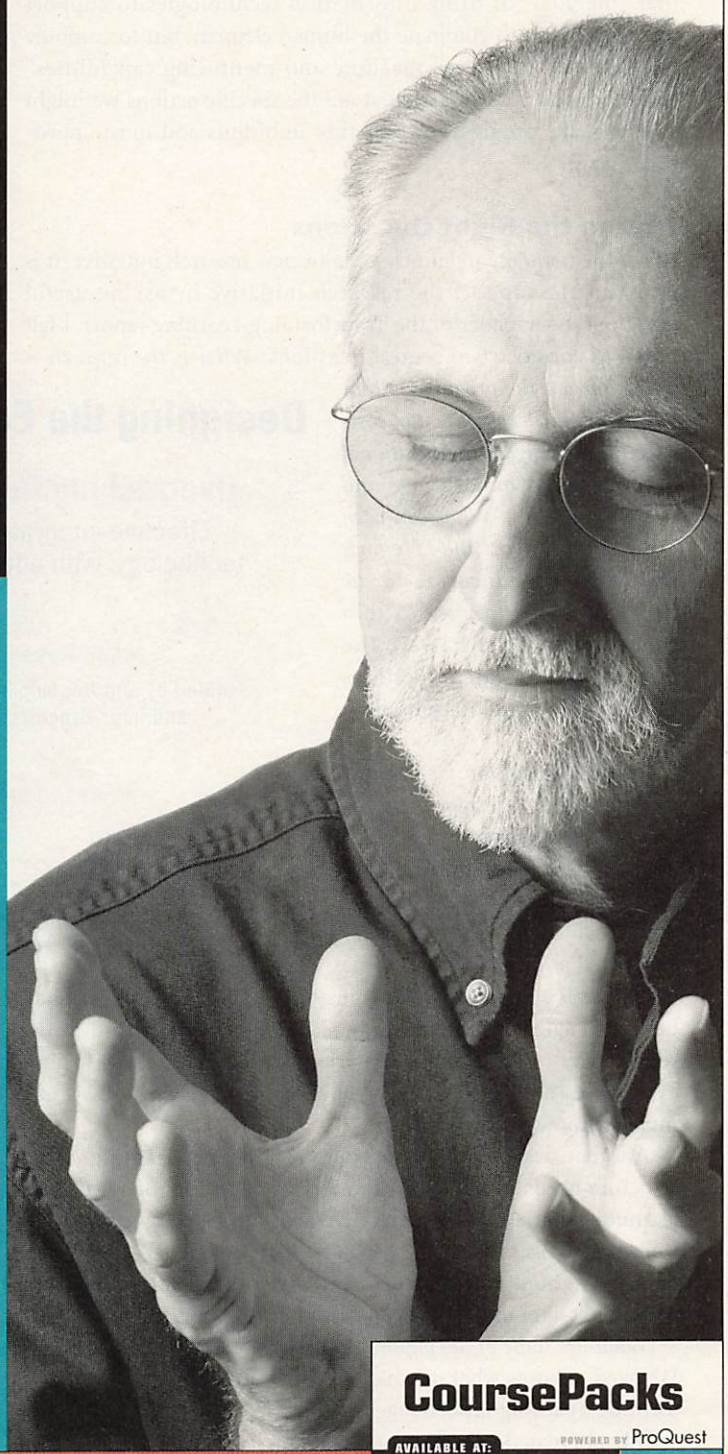
One of the most encouraging aspects of the report is that it calls for major research on how to leverage information technologies for more effective, less costly education and training. Emphasis is placed on research in the learning sciences—to find out how we can teach and learn better through the appropriate use of information technologies. It is time now for ambitious and innovative work in education, but to do this, we need to know more about our learning processes and how our minds and bodies can interact with and make the best use of information tools.

A Careful Rethinking

The normal cycle of technology adoption is that people first use innovative tools to continue doing what they are already doing. One of the findings in the Transforming Learning report confirms that we have seen widespread experimentation with grassroots applications in recent years. However, most of this work has been *evolutionary*, rather than *revolutionary*. In other words, we are using powerful tools to support existing processes and systems, but very little of this work is contributing to a true paradigm shift.

The Transforming Learning panel notes that successful integration of information technology requires "a careful rethinking of the targeted processes and social institutions" (Transforming Learning report, p. 5). We should not assume that the educational systems of the future will be built on our current structures.

A COURSEPACK CAN BE BOUND. AND IT CAN BE COMPLETELY LIBERATING.



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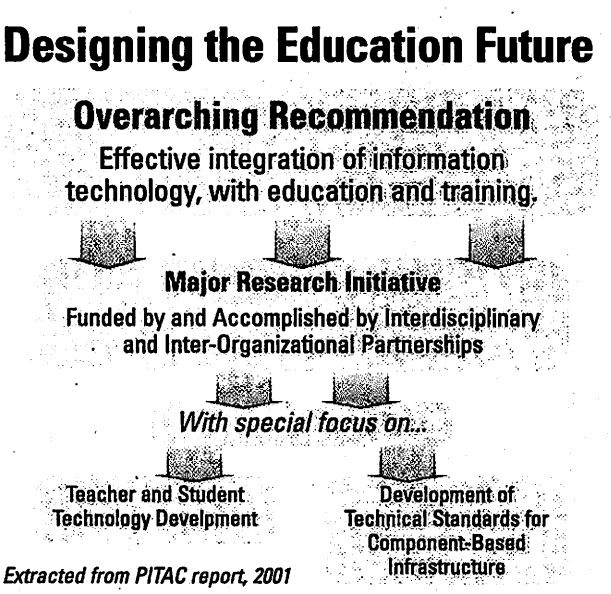
What does this mean for those of us on the front lines, who are working with information technology tools to improve education? What do we need to know and do? Most of us believe that we have sufficient technology in place as a powerful tool to support teaching and learning, and most would agree with the statement that "the goal [of using information technologies to support learning] is not to eliminate the human element, but to combine the best of human and machine and mentoring capabilities" (PITAC report, p. 12). So, what are the specific actions we might take to make progress towards this ambitious and most appropriate goal?

Asking the Right Questions

Given the mandate to launch a major new research initiative, it is now time to support the research initiative by asking useful questions. As a reader of the Transforming Learning report, I felt urged to consider two central questions: *What is the research—and what are the programs—that will speed the development of cost-effective and engaging educational experiences for our teachers and students?* —and—*What can each of us do to support the IT efforts that will take education to the next level of effectiveness?* Within this framework, what are the more precise research questions that might be asked? Here are a few.


Designing the Education Future
Overarching Recommendation
Effective integration of information technology, with education and training.
Major Research Initiative
Funded by and Accomplished by Interdisciplinary and Inter-Organizational Partnerships
With special focus on...
Teacher and Student Technology Development
Development of Technical Standards for Component-Based Infrastructure

Extracted from PITAC report, 2001

What is our vision for learning and how do we design an infrastructure to support it? Our national infrastructure for learning will need to be flexible, well developed, and properly supported and maintained. Some design goals suggested in the Transforming Learning report may be easy to agree on, such as ready accessibility of online programs, repositories of educational materials, customization of learning experiences, and personal digital libraries for managing one's accumulated knowledge resources.

Another design goal is that our teaching and learning infrastructure needs to be low-cost and scalable to support "access to learning materials and systems anywhere, anytime, by any authorized user." This vision might include high-end systems linked to hand-held, book-sized devices, and access to a base of learning materials—akin to the Carnegie visionof free public libraries.

What are some of the physical layers of a learning infrastructure? We need to know what to build and what not to build. The Transforming Learning report suggests that we need—as a nation—a "richly populated education and training infrastructure." Some of the components of such an architecture would be:

- Web-based templates and applications
- Complex visualizations and simulations, and multi-player gaming
- Adaptable capabilities for student assessment
- Personal digital educational records
- Content development tools and technologies
- Technologies for tagging materials
- Adaptable materials

What are the standards and processes that will enable the components of the learning infrastructure to be easily and affordably used? Effective infrastructures depend on standards. Standards support interoperability as well as the development of system components. The Transforming Learning report encourages the adoption of common technical standards such as those being developed and promoted by broad-scale consortial efforts. Some of these include the IEEE Learning Technology Standards committee (itsc.ieee.org), the IMS project (**www.imsproject.org**), and SCORM (Sharable Courseware Object Reference Model) from the DOD Advanced Distributed Learning initiative (**www.adlnet.org**).

How can we promote sharing and publishing of educational content and information resources? Assuming that sharing and publishing will follow naturally if we have common technical standards for content development might be a stretch. Development and publishing efforts within education will require content development tools, as well as release time and rewards for faculty who build sharable objects. An infrastructure that encourages recognition and sharing can also be a supporting factor. The MIT Open Courseware initiative is an example of this supportive framework for designing and building expanded, enriched bodies of content, materials, and curricula for the learning infrastructure.

What are the tools and services that can support teaching and learning? Major research is required to develop the tools to support the process of teaching and learning. Prominent examples are collaboration tools to support and maintain communities of learning, online security methods, digital libraries, and technologies to ensure access for all users. These research areas will require broad interdisciplinary collaboration, from social and cognitive scientists to computer and information scientists.

How will content evolve and be structured for new learning environments? More research must be directed towards the structuring of content itself. For example, we know that computer simulations and dynamic illustrations of core concepts can reduce the time needed for learning difficult concepts. Research can assist in determining the basic principles behind the methods, strategies, and tools to develop learning materials. We know that learning requires time. How can we make the most of that time?

Closely related to the structuring of content for the learning of individual concepts is the structuring of content for courses, course clusters, and disciplines. One example of new content structure involves creating databases of learning materials for course clusters, rather than just for courses. These databases can be structured around concepts, current events, and complex applications problems rather than around arbitrary course frameworks. This does not mean that courses go away, only that the one-to-one correspondence between courses and course materials becomes irrelevant.

Managing and Executing the Research

The major research initiative recommended in the Transforming Learning report will, hopefully, become a reality. This research initiative will need to be developed, managed, and sustained over at least a ten-year period. The panel specified that the research should be collaboratively funded across industry, private foundations, and state and federal government.

Of all our national goals for the next ten years, designing and deploying an effective learning infrastructure must be a top national priority. It is time to extend Jefferson's prescription for a strong democracy.

Recommendations from the 2001 PITAC Report

Overarching Recommendation

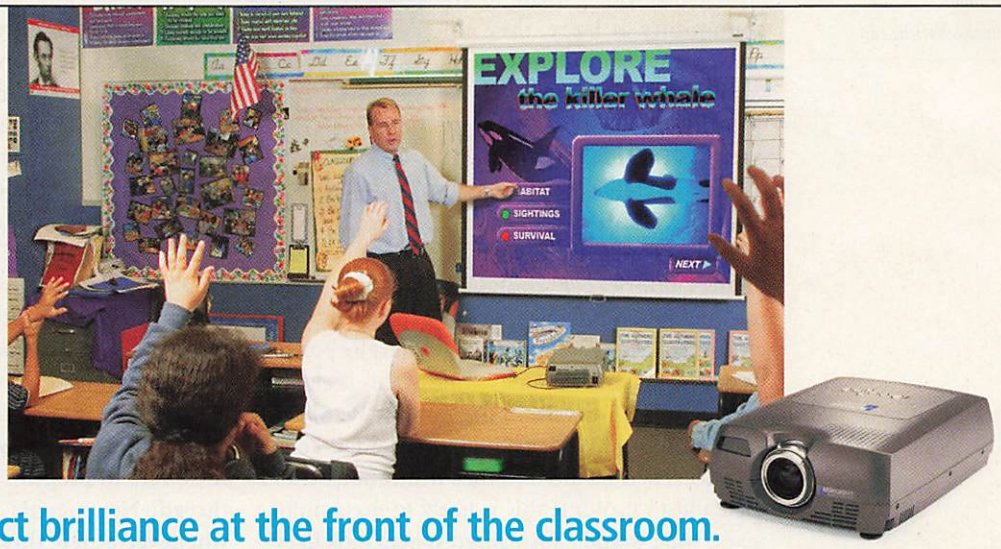
Make the effective integration of information technology, with education and training a national priority.

Supporting Actions

- **Establish and coordinate a major research initiative focusing on:**
  - Learning technologies and sciences
  - Information technologies for education and training
  - Requirements for learning and teaching information technology fluency
- **Establish partnerships involving government, university, industry, and foundations to support the pursuit of the research initiative and to cofund and collaborate in that research**
- **Enable educators and related professionals to use information technology effectively**
- **Work with industry and academia to develop technical standards for extendable component-based technology and infrastructures that can be widely used in online education and training.**

PITAC Report (2001). "Using Information Technology to Transform the Way We Learn." Arlington, VA, President's Information Technology /Advisory Committee, Panel on Transforming Learning. ***http://www.itrd.gov***

Judith V. Boettcher, Ph.D., is the executive director of the Corporation for Research and Educational Networking (CREN). ***www.cren.net; jboettch@cren.net***



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Sally M. Johnstone

Open Online Course Content

As founding director of the Western Cooperative for Educational Telecommunications (WCET) at the Western Interstate Commission for Higher Education (WICHE), Sally Johnstone serves as a resource on higher education technology issues. She also serves on the Board of the American Association of Higher Education, the U.S. Open University's Board of Governors, and the Advisory Panel for the Consortium for the Advancement of Private Higher Education.
sjohnstone@wiche.edu

What would happen if we had an open or community approach to online course content in higher education? We have an Open Source computer operating system, Linux. The source code is posted online and anyone can download it and modify it. I understand a committee of senior Linux users reviews the modifications in case others want to use them. There are also "open community" tools for the development of online courses, such as Prometheus, an adaptable educational software platform developed by George Washington University. The members of this community pay the owners of Prometheus to participate, but then they can download the source code and modify it. If the modifications are deemed widely useful to the community at large, they are incorporated into subsequent versions of the software.

So, why not some sort of open system for course content online? A colleague, Marshall Smith of Stanford University, recently suggested this concept to me. Our brief conversation on the topic started me thinking about how it might work.

One college or university could start by posting its course materials online (some of this is already starting at MIT thanks to the Andrew W. Mellon Foundation and William and Flora Hewlett Foundation). Then faculty at other institutions could then add to it. While this is likely to occur informally, what would a formalized system look like?

One approach would be to involve a formal multi-institutional faculty coordinating group that would review additions (and presumably deletions). These would then be incorporated in the next version of the course materials. This would result in an open community approach to course content.

Another approach might be more in the spirit of Open Source. A Web site would be set up for each open course. Faculty from anywhere could then create threaded variations associated with that particular course. If the course were introductory statistics, there could be threads with titles such as: Stat for Social Science Majors, Stat for Business Majors, Pre-med Stat, Community College Stat, and the like. Any one could add a thread that included any or all of the previous version's course materials. Within a few years any faculty member anywhere could teach their version of statistics from one of these threads.

The first approach assumes that faculty who would use the open courses would use the "official" version. That would be one way for statisticians to maintain some control over the content of a statistics course. The second approach assumes that faculty members teaching statistics would be able to discriminate good material from bad. I think that is probably true. However it is possible that one small piece of misinformation could be compounded fairly quickly.

Perhaps a better approach would be something in the middle of these two. As soon as a new course thread is entered into the Web site, a couple of experts would review it. These reviews would be posted with the new thread so that less-than-expert potential users of the course thread would know whether to accept all aspects of the new thread.

All right, where would we get these expert reviewers to diligently analyze each new course thread? New people would need to be alerted whenever a new thread appeared. They would spring into action to ensure no thread was left unreviewed once it landed on the Web. You know, they are beginning to sound more to me like the *Dragon Riders of Pern* created by science fiction writer Anne McCaffrey in the late 1960s than academic statisticians. In the story, dragons and humans bond for life, uniting against the menace of "thread," little bundles of destruction that fall from space every so often.

Come to think of it, maybe the model needs more work.

Illustrated by James Genus Jr.

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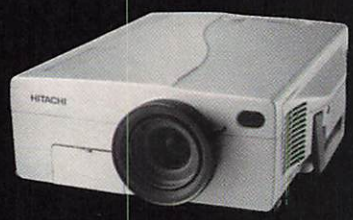

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The Muddiest Point

David G. Brown

David Brown is vice president and dean of the International Center for Computer Enhanced Learning. He has served as president of Transylvania University, chancellor of the University of North Carolina at Asheville, and chair of several national groups, including the AAHE and the Higher Education Colloquium. As provost of Wake Forest University, he founded the Annual Conference of Ubiquitous Computing Colleges and Universities, and founded the Journal of Computer Enhanced Learning.
brown@wfu.edu

For the first time, this semester I'm requiring each of my students to e-mail me a sentence or two about the section of the required textbook reading that they understand least well, their "muddiest point." These e-mails are due at least two hours prior to class.

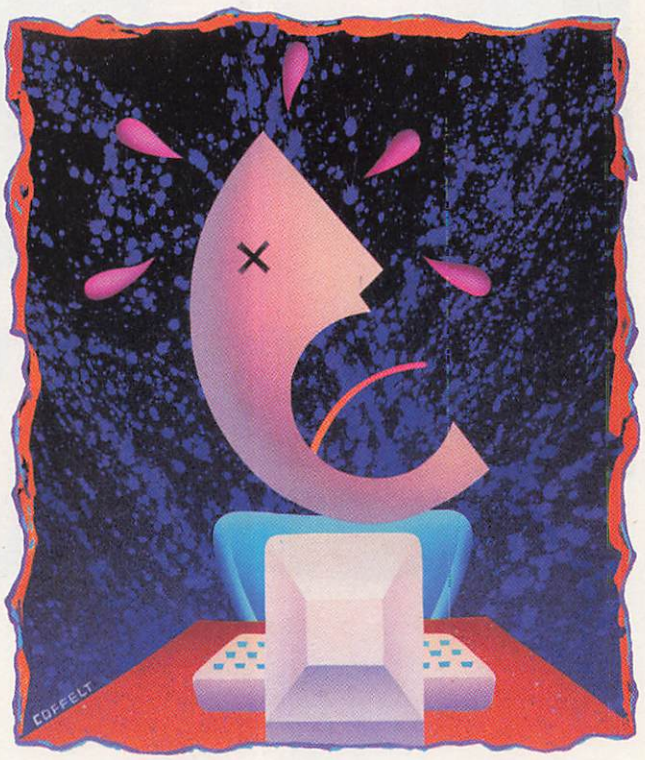
This simple innovation has been well received by my students and has proved more beneficial than my most optimistic expectations.

My use of the "muddiest point" responses varies. If half the students focus upon one particular page, the whole class period might be devoted to clarifying that problem. If a passage is mentioned by only one student, I may prepare a response specifically for that student and avoid using class time. If many students are struggling with the entire assignment, I might send a document that includes all submitted "muddiest points" with my responses to each to the entire class.

To carry this out, I paste all "muddiest points" into a single word-processing document, and then insert my comments in a color font. The document is then e-mailed to the entire class. In some cases, an entire lecture may be devoted to a series of the "muddiest points." Another variation could be to ask one student to write a paragraph of clarification that will help another's understanding.

At its most basic level, the "muddiest point" exercise encourages students to read the text prior to class. When comments are shared among classmates, there is a new level of accountability. Feedback is provided prior to the lecture, so that classroom strategy can be adjusted "just in time." Classroom time is devoted to topics that students regard as the most difficult. Discussion can start from "where the students are," rather than from where the professor thinks the student are. The language used can be that of the student. Students who raise difficult questions can feel that they are contributing to the learning process. As much of the question-response is in electronic form, the topics can be archived for review and repetition.

Here we see technology at its best. E-mail is simple to learn and easy to use. Individual students get custom attention. They feel empowered. Feedback loops are short. Through archiving, preview and review are supported. Through sharing responses, collaboration is encouraged. By relating to students outside of class time, valuable face to face time is available for other uses.



Before the widespread use of the computer, these strategies simply weren't available, at least not for middle to large classes. It's not possible to talk with 100 students just before and after class. But with the computer, it is now realistic to type responses to 100 students, especially if you are aided by teaching assistants.

The "muddiest point" exercise is working well for me. It may be worth a try for you.

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Steven W. Gilbert

Steven Gilbert joined the American Association for Higher Education (AAHE) as Director, Technology Projects, in July 1993. He founded the TLT Group as the Teaching, Learning, and Technology Affiliate of AAHE in January 1998. He was previously vice president of EDUCOM, where he created and led the Educational Uses of Information Technology (EUIT) program and the EDUCOM Software Initiative (ESI). He also moderates the Internet listserv AAHESGIT.
gilbert@tltgroup.org

Sacrifice Time to Integrate Technology? Why Bother?

Most of the educational uses of information technology that I know about increase the time required by the faculty member—first to learn how to use the technology and subsequently to implement and integrate it. This is especially true for applications that enhance communication between faculty and students. Students' appetites for course-related communications seem to rise with the convenience of that communication, while e-mail seems extremely well-suited to the lifestyles of many students.

But once faculty begin corresponding with their students via e-mail, they often feel pressed to respond rapidly to students, even on evenings and weekends. So, why should faculty members embrace changes that are likely to increase their workload?

At the end of my presentation at a recent conference, I was approached by someone who described himself as a "mainstream" faculty member who was intrigued with the educational possibilities that new technology applications and courseware seemed to be offering. However, he felt that he already had a full time job and that any effort to learn how to use a new tool or approach would take time away from his personal life—from his time with his family or from his time to sleep.

He said that he was willing to make this kind of sacrifice, to make this personal investment. However, he wanted reassurance that after doing so there would be some related gains—not only in the quality of education for his students, but also in some savings of time and effort for himself. He especially wanted to hear that if he tried to make these changes, that within a year or less he would be able to return to something like his current workload level and his current lifestyle, with the same amount of personal time available to him once again. He asked me to identify some educational applications of technology that might meet the criteria he had just established, in order to give him some hope.

I think he was clearly expressing one of the fundamental concerns shared by the majority of faculty who are not "early adopters" of new instructional technology. He was asking a very sound question. And I wish I had more reassuring answers.

Unfortunately, I couldn't immediately think of anything except a few administrative applications. He might learn to use some of the "gradebook" and other record-keeping features of some Course Management Systems and, after a learning period, find that he was able to reduce his course-related administrative workload. Of course, there are some exceptions that offer obvious gains in the teachers' productivity, especially applications that replace some of the time required for the teacher to oversee and correct the repetitious learning of rote skills.

I'd like to offer another version of his question, a question that has shaped my work with colleges and universities in recent months: "*Why bother?*" In particular, why bother making great investments of money, time, and effort to increase educational uses of information technology in colleges and universities?

About a year ago I began a discussion on the American Association of Higher Education (AAHESGIT) Steve Gilbert Instructional Technology listserv that resulted in a document that attempts to summarize the reasons for moving forward under the challenging conditions experienced by that faculty member. You can see the full text at www.tltgroup.org/gilbert/Why-Bother.htm.

I hope to extend and improve this document. Please suggest more reasons for why "to bother" to gilbert@tltgroup.org.

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Track 6 sessions, November 29-30, 2001

Track 6: Owning, Sharing, or Stealing Online?

In a featured track at the Syllabus fall2001 conference, the TLT Group and other academic leaders will examine issues evoked by the phrase, "...owning, sharing, or stealing online" and develop recommendations. This 8-session track will provide attendees with a unique opportunity to go beyond digital rights management—including an exploration of the emerging role of Open Source principles, practices, and tools—and to connect with core values and practices in higher education institutions. In our expanding digital realm, who makes the rules? What are the terms of exchange and collaboration?

Learn effective ways to support faculty efforts to integrate technology into teaching and learning in this dynamic environment. Exchange ideas with other educational leaders as they respond to new laws, assess risk in uncharted territories, and plan comprehensive changes for their institutions. ***Full conference information: www.syllabus.com***

Thursday, November 29

10:30AM-11:30AM

Mapping the Issues: *Policies, Practices, Rights, and Responsibilities (CAO/Campus Team*

This is the opening session of Track 6, in which multiple perspectives on the expanding digital realm and its impact on higher education will be addressed. Led by a Chief Academic Officer, the team of presenters will act as mock TLTR members who will then participate in subsequent track sessions. The CAO summarizes the basic issues and challenges the participants to address them from the point of view of their own unit within their college or university.

Tom Curry, *Provost, University of Massachusetts at Dartmouth (Invited)*
Steven W. Gilbert, *President, The TLT Group*

1:00PM-1:50PM

Institutional Policy Issues, an External Perspective: *Prizes, Profits, or Penalties for Course Materials?*

What are the most pressing issues for educators in the areas of Web and print publishing, permissions, and electronic reserves? How are online course materials made available, and what are the best roles for commercial services? How can commercial services and products support Open Source development? These and other questions are considered in this session, from the perspective of an education consultant who has explored these issues from the inside out.

Farimah Schuerman, *Senior Associate, The TLT Group*

2:00PM-2:50PM

MIT's Open Knowledge and Open Courseware Initiatives: *Implications for the Ownership and Development of Instructional Materials in Higher Education*

What are the MIT Open Knowledge and OpenCourseWare Initiatives? What are the implications of these projects for the ownership and development of instructional materials in higher education? How do these programs relate to Open Source ideas? Participants will explore these and other topics, including the Support Service Crisis, related to the MIT Open Knowledge and OpenCourseWare Initiatives.

Phillip D. Long, *MIT*

4:00PM-4:50PM

Student Issues: *Guiding, Training, or Punishing Students for Online Behavior*

Student affairs professionals will be especially interested in this session which examines the issues involved as campuses must prepare to respond to the activities and needs of students in the online dimension of their lives. How can an institution establish guidelines and standards for student behavior online? What will you do in response to the next crisis beyond Napster? Admissions, freshman or entry orientation, privacy, registration information, and plagiarism are also considered.

Phillip Bernard, *Director of Residential Life, Wentworth Institute of Technology*

Friday, November 30

1:00PM-1:50PM

Open Source Professional Development: *Materials, Resources, and Planning*

Faculty, staff, and administration are facing enormous challenges as new options for improving teaching, learning, and administration dot the educational landscape. Institutions that support faculty and professional staff development in the face of so many options will be the real benefactors. Learn how to use some of the policies, practices, and tools from the Open Source community to encourage, support, and build on the continuing efforts of individual faculty members, faculty development professionals, librarians, technology professionals, and other academic support professionals; share the work required to develop and improve new instructional resources and tools; and develop and provide professional development resources and services.

Michael Theall, *Assoc. Professor and Director, Online Writing Improvement Project, University of Illinois*

2:00PM-2:50PM

Assessment Issues: *The Impact of Policies and Practices*

Institutions will need to assess the policies and practices surrounding their digital infrastructure, including digital rights management, policies for student use of online systems, and Open Source content development. Participants will explore the effectiveness of belonging to a consortium for such purposes. The evaluation/assessment approach will focus on collecting information that will enable a consortium member to contribute more effectively and to make decisions that are likely to increase the benefit of participation—especially in consortia that focus on Open Source policies and practices.

Phillip D. Long, *MIT*

4:00PM-4:50PM

Inter-Institutional Issues: *Resources, Possibilities, and Economic Options— The Open Course Model*

Inter-institutional collaboration is the key to expanded possibilities for resource sharing and economies made possible through new digital technologies. The resources currently available at any single institution—even a large university—for professional development are tiny in comparison with the pace and scale of change now needed. We are facing an unprecedented need for professional development that crosses the usual boundaries of departments, offices, divisions, schools, and campuses. Learn about projects, such as Open Course Initiatives that will extend the resources of institutions.

Tom Carey, *University of Waterloo and MERLOT (Invited)*
Robert Stephenson, Wayne State University

5:00PM-6:00PM

Synthesis and Recommendations: *Multiple Perspectives from the Digital Realm (CAO/Campus Team)*

The mock TLTR members and session leaders are re-convened for this final Track 6 session, in order to synthesize what they've experienced during the previous track sessions and attempt to develop recommendations. These recommendations should be suitably generic so they may be applied to most of the institutions represented by those who register for this conference.

Tom Curry, Provost, *University of Massachusetts at Dartmouth (Invited)*
Steven W. Gilbert, *President, The TLT Group*

Call for Papers

Plan now to present at **Syllabus 2002**

Ninth Annual Summer Conference and Technology Expo

Submission deadline: November 30, 2001

Conference Information

Syllabus conferences attract faculty, administrators, and IT professionals who want to explore the latest applications of information technology in higher education institutions. The conferences offer an environment in which attendees encounter exemplary campus implementations for teaching as well as administration, and they discover how new media are best integrated into the teaching and learning process.

Content Areas and Tracks

In eight tracks, we examine the central themes and key technologies which have become increasingly important to diverse constituent groups in higher education as they move forward with strategic technology planning and innovation.

Track (1) New Technologies Update:

A look at current and emerging technologies and their applications in higher education environments.

- Handheld devices and PDAs
- Advanced networking applications and the Next Generation Internet
- Internet2 update
- E-books
- Laptops programs on campus
- Smart buildings and classrooms
- High-end video applications
- Visualization, 3D modeling, and virtual reality applications
- Quantitative and statistical tools update
- Trends in personal computing and communication devices
- Wireless applications in education
- New distributed computing applications in education

Track (2) Administrative Systems for the Academic Enterprise:

A track designed especially for those charged with the operation of campus-wide administrative systems.

- Student administration systems
- EDI in the registrar, admissions, and records offices
- Smart card systems on campus
- Portals for admissions and alumni communications

Track (3) Technology Infrastructure and IT Planning Issues:

Faculty, IT, and administrators plan together for change and maintenance of technology programs on campus.

- Change management and IT planning
- Interactive communications infrastructure
- Network architecture for scalability and reliability
- Campus portals
- Distance education programs and technology directions
- Professional development and faculty support
- Going the distance: reaching new student populations
- Legacy systems, entrenched technologies, departmental interests, and technology selection policies
- Online DL programs and collaboration technologies
- Scalable models for distance and distributed learning
- "The other infrastructure:" planning for technology on campus
- The globalization of .edu: policies and practices

Track (4) Standards, Interoperability, and Open Source:

Standards, implemented on a broad scale among higher education institutions, pave the way for resource sharing as well as improved workflow. Will open source development flourish in academic environments?

- Open source strategies
- XML: the evolution of markup standards
- IMS update
- Image and metadata standards
- Web search engines and finding tools
- Visual data description, storage, and retrieval
- Peer-to-peer networking strategies
- LINUX in the campus community
- Security for campus environments
- Secure access to resources with PKI/digital certificates
- Accessibility issues and universal design

Track (5) New Publishing Models and Intellectual Property:

Individual and institutional concerns for digital rights, resource management, and autheniticity as new publishing models develop.

- Web publishing for the academy
- Intellectual property rights for faculty
- Digital rights management on campus
- Content management systems for .edu
- Digital libraries: resource aggregation/distributed collections
- Data permanence: choosing the right technology
- Authentication of digital resources

Track (6) Web-Based Environments for Teaching and Administration:

An examination of technology trends, pedagogical implications, and administrative applications in Web-based or Web-enabled campus environments.

- Web course development tools and Web-enhanced teaching environments
- Web-based learning management systems/course management systems
- Instructional design for Web-based courses
- Web-based content resources in education
- Interactive and streaming media
- Staffing, hardware and software requirements, and long-term planning for Web-based programs
- Dynamic Web updating
- Back-end databases
- Managing course size on the Web: success criteria

Syllabus

Santa Clara Convention Center • Santa Clara, Calif.

Main conference: Monday-Wednesday, July 29-31 • Pre-conference: Saturday-Sunday, July 27-28

Track (7) Evaluation and Assessment Strategies:

Student assessment and technology program evaluation are considered in this track, along with the question of why new assessment and evaluation strategies may be needed to accompany technology innovation on campus.

- Technology program evaluation standards
- Automated feedback to students
- Security issues and online testing
- Accreditation and online learning programs
- Student assessment practices for the wholly online program
- Formative and summative evaluation strategies

Track (8) Faculty Innovation—Case Studies:

An opportunity for faculty to share their successes in using technology for teaching and course administration.

- Showcase of teaching with technology: lessons learned
- Adoption success stories: "real world" implementations of new technology
- Cutting-edge technology and pedagogy
- Collaboration among students and faculty using Web/Internet technologies
- Curriculum redesign and lifecycling examples
- Student perspectives of Web courses and online programs

Pre-Conference Workshops and Seminars

In addition to presenters for the main conference program, we are seeking individuals to lead full- or half-day workshops or seminars for the pre-conference program. The workshops, held in computer labs, provide hands-on learning with specific technologies such as the Web or multimedia; seminars are classroom-style presentations, not held in computer labs, that explore important topics in the application of education technologies. Seminars are especially sought.

Syllabus2002 Conference Program Advisory Board

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How to Submit a Proposal

Session Types

Syllabus is now accepting proposals for the following session types:

- One-hour breakout presentation—main conference only
- One-hour panel session—main conference only
- Poster session—main conference only
- Half-day hands-on workshop (in a computer lab)—pre-conference only
- Full-day hands-on workshop (in a computer lab)—pre-conference only
- Half-day classroom seminar (not in a computer lab)—pre-conference only
- Full-day classroom seminar (not in a computer lab)—pre-conference only

Submit your proposal online: www.syllabus.com

The final date for submissions is November 30, 2001. Notification of acceptance will be made by January 7, 2002. Proposals will only be accepted electronically only. They should be submitted through our Web site at www.syllabus.com.

Please note: As a condition of acceptance, each presenter will be required to submit, by March 15, 2002, a 1,000- to 1,500-word article for consideration for publication in the conference proceedings, in *Syllabus* magazine, or on SyllabusWeb.

Submission Guidelines

The submission form will ask for the following information:

- The title of the presentation, to be used in the conference program
- An abstract of the presentation content (600 words or less)
- An indication of the conference track(s) into which your topic would most likely fall
- The proposed format
- Presenter bio (one 75-word paragraph)
- Brief description of the presentation for the conference program (one 100-word paragraph)
- Complete contact information for each presenter or co-presenter named
- Any further information that might be helpful in determining the relevance of your topic to the conference themes

Interested parties are invited to submit proposals via SyllabusWeb. We will consider all relevant proposals, so if you have a compelling education technology topic related to but not specified in the above list, please feel free to submit a proposal.

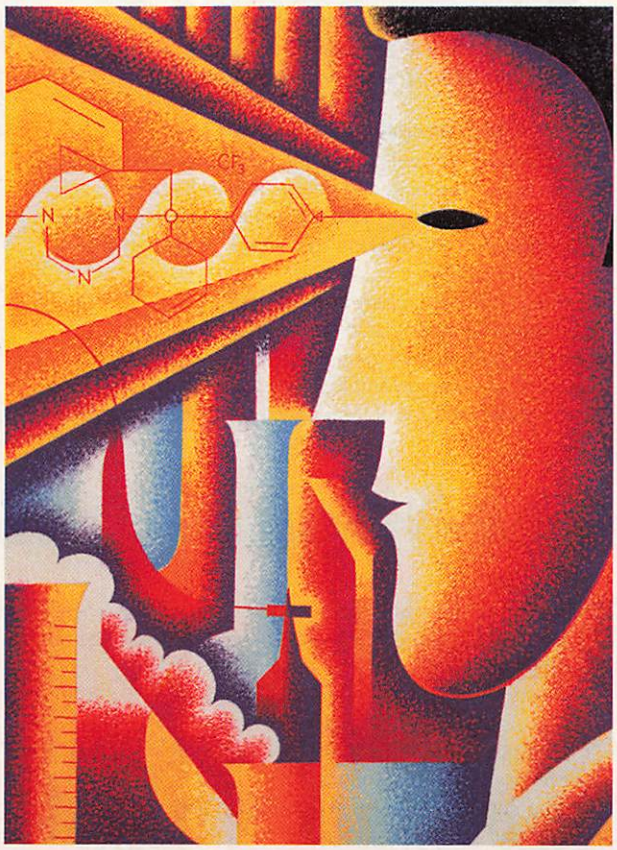
Speaker Discount

Presenters whose proposals have been accepted are entitled to receive a "speaker" discount of approximately 35%.

www.syllabus.com

Taking Chemistry Online with Digital Video

By Catherine Murphy



The anticipated tidal wave of 2 million new students entering higher education in 2010 has forced institutions around the country to seek out ways to accommodate the influx and resulting strain on campus resources. Anticipating a 43 percent increase in full-time enrollment in less than 10 years, the University of California-Berkeley has been considering a number of options, incorporating technology where feasible to lessen the impact of high enrollments and expand learning opportunities. Digital Chemistry 1a serves as an example.

Perhaps hardest hit by the bump in enrollment in higher education over in the next several years will be introductory-level courses that already fill large auditoriums to capacity. Two obvious solutions are to move courses to online environments or build larger lecture halls. But a more strategic initiative is in place at UC-Berkeley, which has developed a set of online resources to enhance and supplement the campus's most heavily enrolled course, Chemistry 1a. The new course, called Digital Chemistry 1a, is composed of a mix of traditional tools (lecture and lab) and online content (including online lectures, self-correcting quizzing, and lab support).

The course was developed to help reduce the number of faculty members and graduate student instructors (GSIs) teaching in the fall and spring, so that more of them would be available to teach in the summer. Another priority was to reduce the amount of time students spend in lab, in order to increase the number of lab sections being offered. With 2,000 students already enrolled in the course, resources were stretched to the maximum. With these goals in mind and a Mellon grant in hand, the chemistry department launched a new course in Fall 2000. Principal faculty developers were Drs. Alex Pines and Lawrence Rowe, along with project director Mark Kubinec, Web designer Jonathan Henke, and principal investigators I. Michael Heyman and Diane Harley.

Digital Chemistry 1a is designed to use technology as a means to enrich teaching and learning rather than as a replacement for face-to-face teaching. Although Berkeley

Illustrated by Ian Saxton

does have to reduce the number of students sitting in the lecture and lab rooms, it isn't moving entire groups out of the hall and into the computer lab. Instead, it is experimenting with ways to leverage the regular ebb and flow of student lecture attendance with either a lottery system or a systematic opt-out requirement that would have some students viewing virtual lectures while others were attending in lecture halls.

Likewise, by providing extensive pre-lab and post-lab support online, the department can reduce the time spent in lab from three hours to two, allowing additional sections of lab. The idea is to provide such a rich collection of online resources that students using them as a supplement to or even replacement for lecture or lab would benefit from the experience.

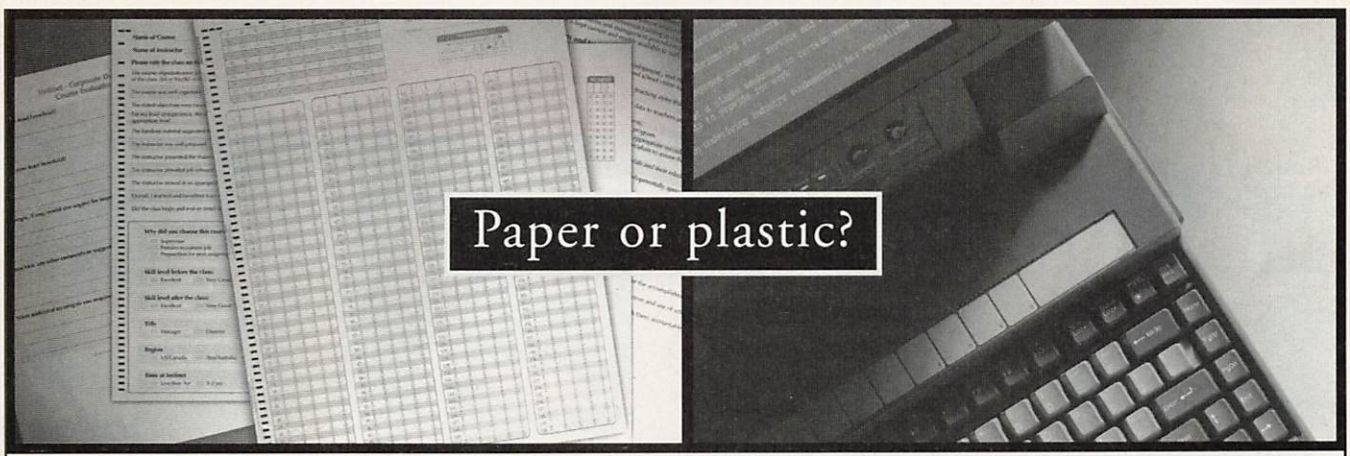
The first priority of the developers was to improve the learning experience for students. Surveys at Berkeley have shown that 80 percent of students do not want an all-online lecture course. The charisma factor is important. Students at Berkeley value the lectures, because they are so well done.

Keeping that in mind, the instructors created a cache of current and archived video lectures, taking a simple pedagogical tool and adapting it to an online environment. The videos, which are highly engaging, are searchable by keyword, so students can either watch the entire lecture or jump to specific parts while studying for an exam. Students can view their own professor's lectures or someone else's. They have all of this available to them as a safety net.

Digital Chemistry 1a also features animated PowerPoint lecture slides, synchronized with the lecture Web casts. The online lab manual offers boxed cross-references to the course textbook and helps students prepare for their laboratory experiments. Online quizzes and assignments provide immediate feedback. The quizzes are automatically corrected and graded, saving the GSIs a large amounts of time. Students each have their own password-protected account, which they use to take weekly randomized quizzes and do the prelaboratory exercises. The course also features an online discussion group, tutorials, and links to online resources such as the periodic table, videos of chemistry demonstrations, and the CRC Handbook of Chemistry and Physics.

Despite the archive of video footage and PowerPoint slides, it's unlikely that the department will ever move to a standardized approach or to an all-online solution. At Berkeley, faculty prefer to build their own courses. They will continue to build and develop new teaching tools, rather than adopt a prepackaged course format. More likely, these materials will continue to be used as available learning objects as the online course archive matures.

For more information on Digital Chemistry 1a, contact ***Diane Harley*** *at UC-Berkeley, dianeh@uclink4.berkeley.edu or take a tour of the course at http://socrates.berkeley.edu/%7Echem1a/tour/tour.htm.*



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A Technical View:

Streaming Web Video

By Kuruvilla Zachariah

OHIO UNIVERSITY EASTERN

I first came across the idea of using streaming video technology in the delivery of course materials in the January 1999 *Syllabus* magazine. In an article in that issue, Lawrence Hinman, a professor of philosophy at the University of San Diego, compared non-streaming and streaming video technologies and described the steps to putting video on the Web. Since then, I've learned from my own experiences incorporating streaming Web video in chemistry classes at Ohio Eastern University.

Video files are usually several megabytes in size and consequently take a long time to download. A non-streaming video file has to be downloaded in its entirety before it begins to play. In streaming video technology, the program downloads the beginning of the file, forms a buffer of packets, and when an appropriate buffer is reached, the client player plays back the packets in a seamless stream. While the viewer is watching, the next portion is downloaded, until the entire file is played without any interruption. Streaming media can include audio, video, animation, and scrolling text.

Producing both live and streaming video require the same equipment: a video camera (analog or digital), video capture card, a video editing program, video encoding technology, a computer with plenty of storage to act as a server, and a high-speed network connection.

In a typical chemistry class, it is often difficult to teach students the correct use of an apparatus and safety precautions for handling chemicals and equipment before they perform an experiment. They also need to have a clear understanding of chemical reactions and how to handle them. Some students may be capable of grasping these concepts by reading a printed lab manual, but most students now learn more through visual aids.

At Ohio University Eastern campus, we have tried to incorporate all of these factors in producing video clips of chemistry experiments for students to view before they actually carry out the experiments. And, for the last two years our freshman chemistry students themselves have been involved in the production of video clips of chemistry experiments.

While commercially produced videos of chemistry experiments are available, we believe that students can absorb and

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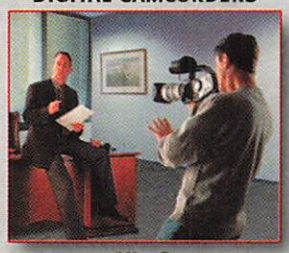

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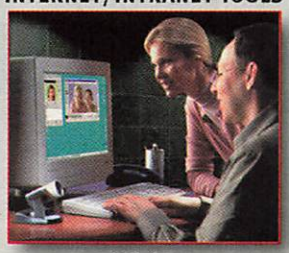

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relate better to demonstrations they produce themselves. In this case, the students researched the topics and wrote outlines. They also demonstrated the techniques of each experiment and provided the narrative. Then videos that were shot were edited, compressed, and several video clips of each experiment were produced.

We bought a license for RealServer software to stream the videos on to the World Wide Web. The video clips are now available at the course Web site for students to view before they come to the laboratory. Computers are also available in the laboratory for students to review all or parts of the video clips while they do the experiment.

When we decided to investigate streaming audio and video, we examined several formats that were available, including RealNetworks, Windows Streaming, and QuickTime. We settled on the Real format because it has good compression while still maintaining good sound and video quality. Real's cross-platform capabilities have also been important to us. The Web was designed to be accessible no matter what computer operating system one might be using—Windows, Linux, Macintosh, BeOS, or DOS.

The RealPlayer is available, for free, for most of these operating systems, so we can be reasonably sure that our students will be able to access the audio and video clips even if they use older computer systems. Our campus is located in a rural area and many of our students can't afford the newest, whiz-bang computers. Also, the Real format can include compression back to RealVideo 5 (they are now at version 8), so that older computers can still view our clips.

Our RealServer is running on a 600Mhz Gateway 7210 server with 512M of RAM, and 2 two hard drives: a 15G drive that contains the operating system files and a 8G SCSI drive for the Real audio and video clips. As additional space is needed to store the audio and video clips, we can add additional drives to the SCSI chain. The server is running RedHat Linux 6.2 as its operating system. We have had very few problems with it. As of now, the Real server has been running continuously for almost three months without requiring a reboot.

We are currently feeding our clips out over a T1 (1.5 Mbs) connection and so far, we haven't experienced problems with network congestion because of the streaming video. But as more faculty and students start using the RealServer, network congestion will become an issue—and my next challenge.

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http://www.eastern.ohiou.edu/academic/zacharik/ Strea-ming/index.htm

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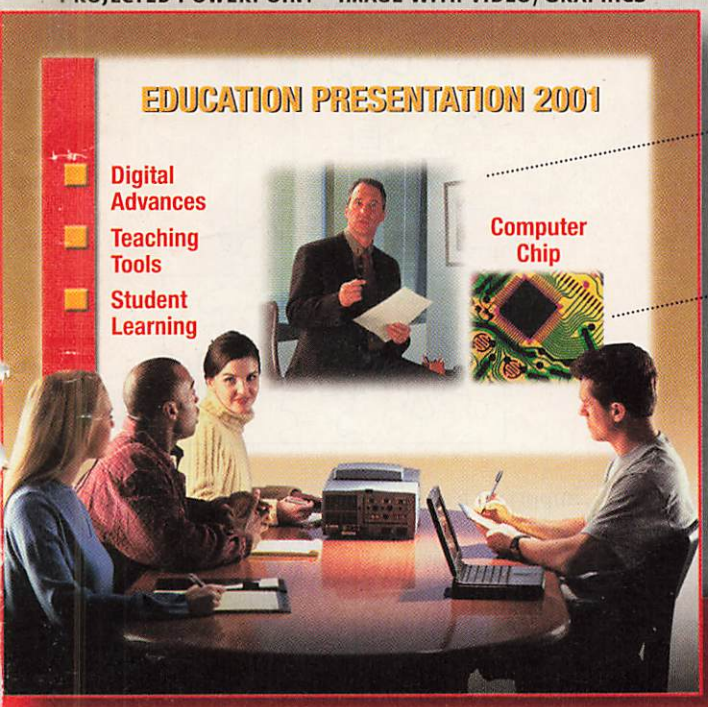

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Michigan State University's LON-CAPA lets faculty develop online course content from open source learning objects; the University of Mississippi's PsychExperiments offer classic experiments in a Web-based laboratory; and Western Carolina University runs controlled experiments on the effectiveness of PDAs on campus.

TECHNOLOGY ACROSS THE CAMPUS

Open Source Objects for Teaching and Learning

Michigan State University's Learning Online Network with CAPA (Computer-Assisted Personalized Approach) is building an open platform for the development and distribution of online content. The network, dubbed LON-CAPA, would make online content freely and openly available to any instructor in the sciences or social sciences. LON-CAPA was developed at MSU's Laboratory for Instructional Technology in Education (LITE), and grew out of earlier MSU initiatives, including the successful CAPA and Lecture-Online platforms.

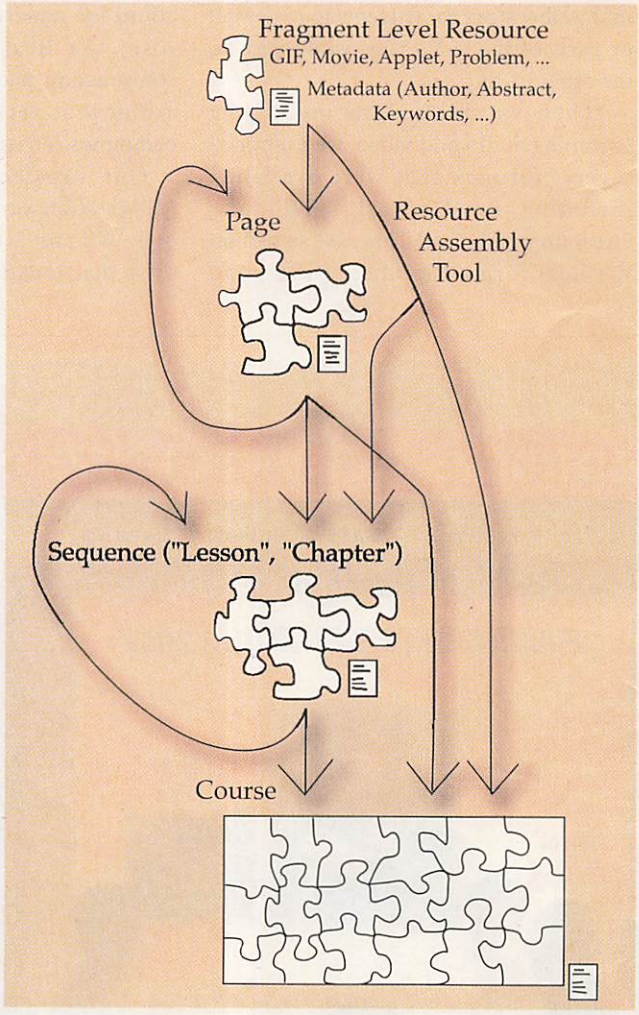
The online content is composed of a resource pool of educational objects, applets, or small slices of content that are written, created, and contributed by instructors participating in the program. Gerd Kortemeyer, director of LITE and principal investigator on the LON-CAPA team, describes the platform as a resource assembly tool, "a shopping cart," with which an instructor can go through "aisles" gathering content until the entire instructional piece is complete.

LON-CAPA is analogous to a coursepak or a jigsaw puzzle, he says. Users decide how much content to take: as little as a single animation, or as much as an entire semester's worth of material.

Think of LON-CAPA as a digital library with an instructional management system built in. Currently, it includes material for courses in physics, calculus, chemistry, biology, food science, and psychology. Some disciplines, such as physics, contain quite a lot of material, enough to fill entire semesters. The platform offers automatic checking of homework problems, with helpful feedback available to those who come up with incorrect answers.

Each component is independent. "Instructors can choose the level of granularity desired," Kortemeyer says. Some teachers may want to select single GIF files, animations, chapter sections, and problem sets, carefully crafting a personalized approach to the course. Others can adopt online textbooks, complete with problem sets and figures.

LON-CAPA's flexibility and adaptability are important features. Since anyone can contribute content, there is unlimited potential for growth. The open source platform is deliberately set up for ease of use, so that selecting and adopting content is very simple. Rather than screen content before it is posted, Kortemeyer's group has opted to let users determine the quality of each posting. "Much as visitors to Amazon.com



post their reviews of books, our users will evaluate material that is put into LON-CAPA and will not only assess it but can actually make improvements to it," he says.

"We have at least 10,000 physics resources," Kortemeyer notes. Other disciplines contain fewer content bits, but more is being added all the time. He notes that the platform isn't specific to the sciences and doesn't deliberately exclude the humanities. "It's just that certain aspects of it, such as the automatic checking of homework problems, lend themselves better to the sciences and mathematics," he says.

Users might draw from LON-CAPA for a distance education course where all of the instruction is delivered in a virtual environment, but they might just as easily use material as part of a lecture course or as lab materials. The adaptability of the platform makes it appropriate for all sorts of situations.

At first glance, one might think that piecing together a course from a number of small fragments would require a large investment of instructor prep time, but in actuality that isn't the case. Kortemeyer says that the granularity options allow teachers to get as detailed in developing the course syllabus as they wish and that building the syllabus takes as long as adopting a new textbook. Once the course gets going, he notes, "there's no homework to grade, which saves a lot of time." As with any online course, however, instructors using the platform should expect to spend some time communicating with their students via e-mail or the built-in communication tools.

At the moment, 18 institutions belong to the LON-CAPA network, and the group hopes to have at least 30 partner institutions within a year. Kortemeyer hopes that in addition to contributing content, many of the users will contribute open source tool code as well, ensuring that the platform will be self-sustaining. Member institutions have to agree to maintain a "library server," storing some of the content, and larger institutions host an access server as well.

Member K-12 institutions have actually been given a server as part of the NSF grant supporting teacher research within the project. MSU has hosted a two-week training session of the first four school districts to join the program, and plans to continue training new partner institutions. Next year's LON-CAPA conference will be held at Florida State University, where Kortemeyer says they hope to draw at least 80 participants.

Their long-term goal is to spin the program off into a not-for-profit self-sustaining organization that maintains the network, manages content royalties, handles maintenance of the library, and provides technical support and regular training sessions. With NSF funding, the group hopes to attract the attention of potential member organizations and quickly build a large base of participants.

For more information, contact ***Gerd Kortemeyer*** *at* ***korte@lite.msu.edu*** *or visit* ***www.lon-capa.org.***

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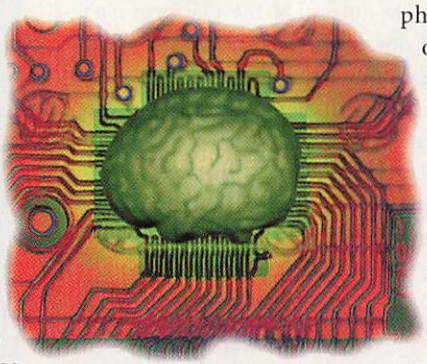
Co-Laborative Psychology Online

Three University of Mississippi researchers have collaborated on an award-winning Web site that enables students and researchers from any campus to conduct an array of psychology experiments from a growing online library of experiments and datasets.

The project, dubbed PsychExperiments, currently contains more than 30 unique psychology experiments available without charge to researchers and students. Its developers, psychology professor Dr. Ken McGraw, electrical engineering professor Dr. Mark Tew, and clinical psychology graduate student John Williams, describe the site as a "co-laboratory," a resource that will grow and develop with the contributions of its users.

PsychExperiments includes replications of classic experiments as well as novel experiments based on commonly taught psychological concepts. The site also offers archived data and Excel macros that produce tables and charts from the raw data. Instructors can conduct the experiments themselves and add their data to the pool, broadening and diversifying the dataset.

The project was launched after McGraw took a University of Mississippi faculty development workshop taught by Tew. The subject, Macromedia's Authorware, turned out to be just the tool McGraw needed to build his own custom experiments. McGraw and Tew began working with



John Williams and soon discovered that they could deliver Authorware programs over the Web: Thus, PsychExperiments was born.

According to McGraw, PsychExperiments offers a number of benefits over running experiments in isolation. "First of all, because all of the material is online, students don't have to go to a psychology lab at an appointed time to do lab research. The Web site is available all the time," he notes. "Second, we offer convenience to instructors, who don't have to purchase, set up, or manage software or databases on their own lab computers."

Says Tew: "For instructors who use these experiments, there are no security issues and no costs, because they aren't storing the data on their own servers."

The Web-based laboratory offers researchers the chance to run experiments over large numbers of subjects, often necessary for getting good results when variables such as handedness, gender, or musical training are used. "We're providing the scientific community with larger datasets for some experiments that really don't work as well with a classroom-sized dataset," says McGraw. "Housing all of the accumulated data in one place allows instructors to investigate phenomena that they might otherwise cover only in lecture rather than experimentally."

Last year, the site won first place in the University of Minnesota's Design Institute learning software competition. More than 300 different classes around the country have used PsychExperiments and at least 30 researchers have contributed experiments. In addition to continuing to build the site, the three collaborators regularly conduct user training sessions and are developing written training materials.

"Our goal is to make the site an independent, self-sustaining endeavor," says Tew. "We'd like it to be more like an online journal and less like a managed project." To that end, they recently installed an e-business class server and are focusing on getting the site to run in a way that will accommodate growth easily.

The team has been discussing funding options that would provide long-term financial backing while ensuring that the site will stay free to its users. "This is an important resource to a lot of institutions," McGraw notes. "We want the project to grow without losing sight of the collaborative concept."

For more information, contact ***Ken McGraw*** *at* ***pymcgraw@olemiss.edu*** *or* ***Mark Tew*** *at* ***eemdt@olemiss.edu.***
Visit PsychExperiments at ***psychexps.olemiss.edu.***

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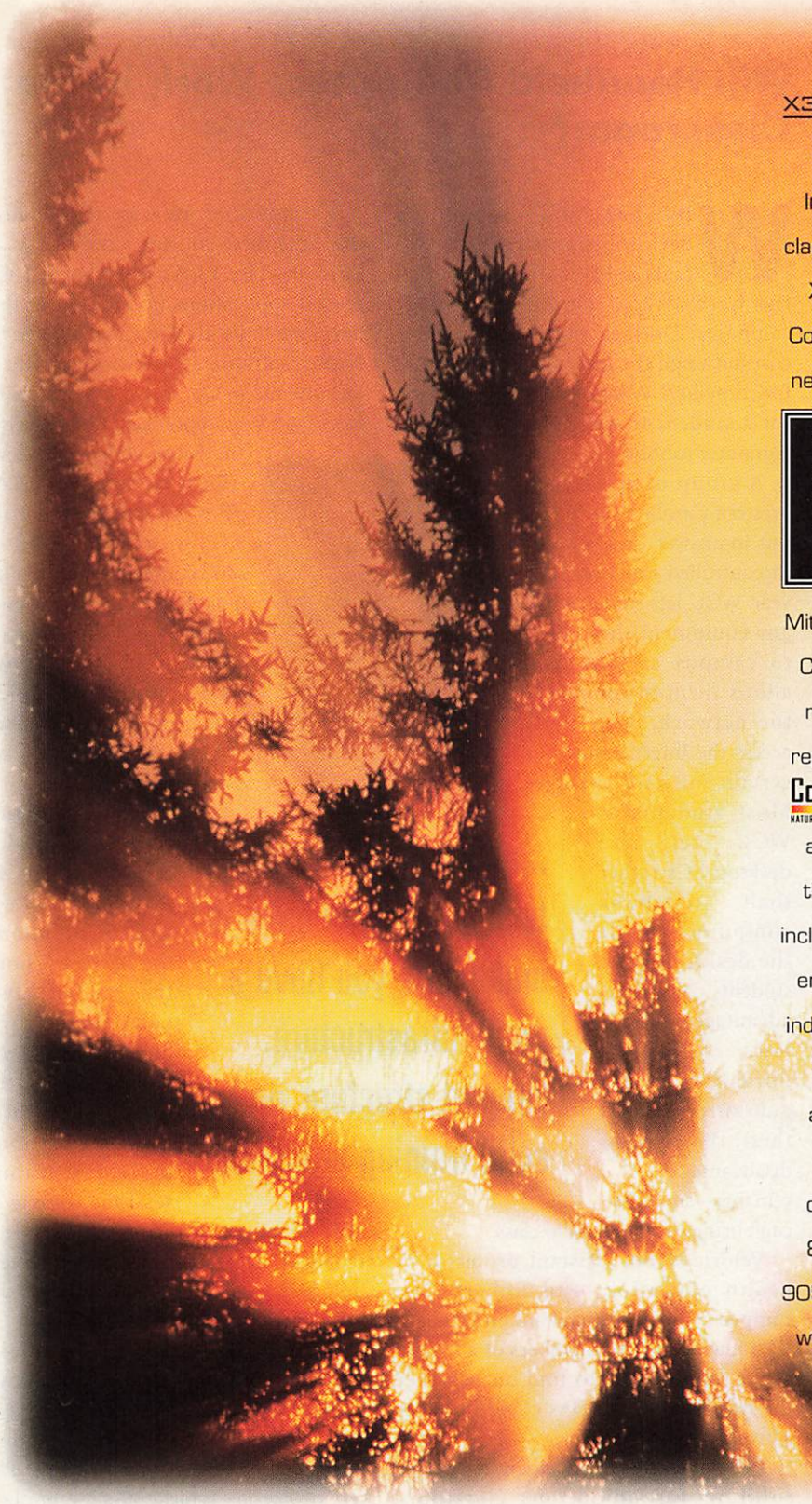

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Will Handheld Computers Work in the Classroom?

Will handheld computing devices—personal digital assistants or PDAs—ever take off as the hardware of choice on college campuses? Do their portability and low cost outweigh the tradeoffs in power and functionality? What can these devices do for a student that a laptop or desktop computer cannot?

A group of researchers at Western Carolina University set out to answer these questions in controlled experiments last year. WCU lets students bring any equipment they choose to campus as long as it allows them to connect to the network, use e-mail, access the Internet, and run certain software packages. Most students at WCU rely on desktop PCs rather than notebook computers. While the desktops offer students compelling advantages, such as lower costs, more durability, and a guarantee against theft, the obvious disadvantage remains—students can't bring the desktops to class.

> **...any time you're using technology, you have to make sure you have a good infrastructure, support structure, and a solid training program.**

Valorie Nybo, assistant professor of health education, and Robert Orr, campus computer consultant and current Web manager, were members of a faculty group who wanted to find out whether the use of wireless PDAs could promote active classroom learning.

PDAs seemed to offer an attractive solution for ubiquitous classroom computing because of their smaller size, ease of transport, silence of use, and lower likelihood of breakage and theft than for laptops. WCU obtained funding to perform two pilot tests, then found nine freshmen volunteers willing to try Palm IIIx PDAs for a semester.

All nine students were registered for the same three courses—health, law, and English. The PDAs were loaded with several applications in addition to those that were built-in. These included Review Master, software for constructing quizzes; Documents to Go, software that converts Microsoft Word and Excel files for use on the Palm; and powerViewer, which converts PowerPoint files for use on the Palm. Also loaded was AvantGo, which converts and regularly updates Web sites for viewing on the Palm. Students were given the devices for use with class assignments and told to use them as much as possible in their coursework and personal organizing.

Despite the attractive technology provided, there were problems with student adoption of the devices. Though the students who participated in the experiment were volunteers, they showed little enthusiasm. Although individual training sessions were available to them, none of the students requested help for any aspect of the technology not directly related to classroom activities.

Second, there were technological hurdles. Students weren't able to download powerViewer, and then it turned out that the size of files created by powerViewer was too much for the Palm IIIx devices. A typical 30-slide presentation could use up 2Mb, half of the PDA's available memory. This limitation prevented the team from using AvantGo, since using it alongside powerViewer would consume all of the Palm's memory.

Students also showed little interest in using any of the course-specific software

functions. Instead, when they did occasionally use the PDAs, they tended to use the personal applications, such as the calendar, calculator, to-do list, and games on a limited basis. Only one of the nine students used the PDA daily.

The initial group of students was then given new PDAs-iPAQs from Compaq. The switch to iPAQ offered a color screen, 32Mb of memory, and such features as instant messaging. Students were enthusiastic about the instant messaging and wireless e-mail functions, using the Internet capability in class assignments as well as for personal applications. However, there were new technical problems. All nine students were accessing the Web in class through a single wireless hub, which slowed access to a crawl. Some Web sites weren't designed to be viewed on a PDA, and the text was unreadable. In addition, there were problems hot-syncing the iPAQs, system crashes, and short battery life.

In a second experiment, four students were recruited, using Palm IIIc PDAs. These students were allowed to use the systems as they wished, with no class assignments. They were far more successful at finding daily uses for the new technology.

Although the experiments were fraught with problems, Nybo and Orr see them as learning experiences. Says Orr, "any time you're using technology, you have to make sure you have a good infrastructure, support structure, and a solid training program." Nybo adds that it's helpful to start with a positive attitude. "With the second group of students, we went into it with the attitude that we would make them successful users of the technology. We used our experience with the first group to solve some problems in advance, preload some materials, and avoid some of the technology problems we had the first time."

Another lesson: freshman students, who are already overwhelmed with the transition into college life, may not be eager to add new technology to their learning curve. Orr notes that upper division students who were also given PDAs were considerably more interested in the new technology. Also, WCU instructors were more enthusiastic about using PDAs than were the freshman students.

Still, WCU is convinced that handhelds hold vast classroom potential. To prove it, they plan to run further experiments, using student volunteers in upper-division courses. They've already determined some methods that should help the new volunteers to succeed, including using progressive skill building with early "no fail" activities, and making it easier to use the PDAs for coursework—for instance, beaming class deadlines to students so that their PDAs are immediately useful.

For more information on the project, contact ***Valorie Nybo (nybo@email.wcu.edu)*** *or* ***Robert Orr (orr@email.wcu.edu)****.*

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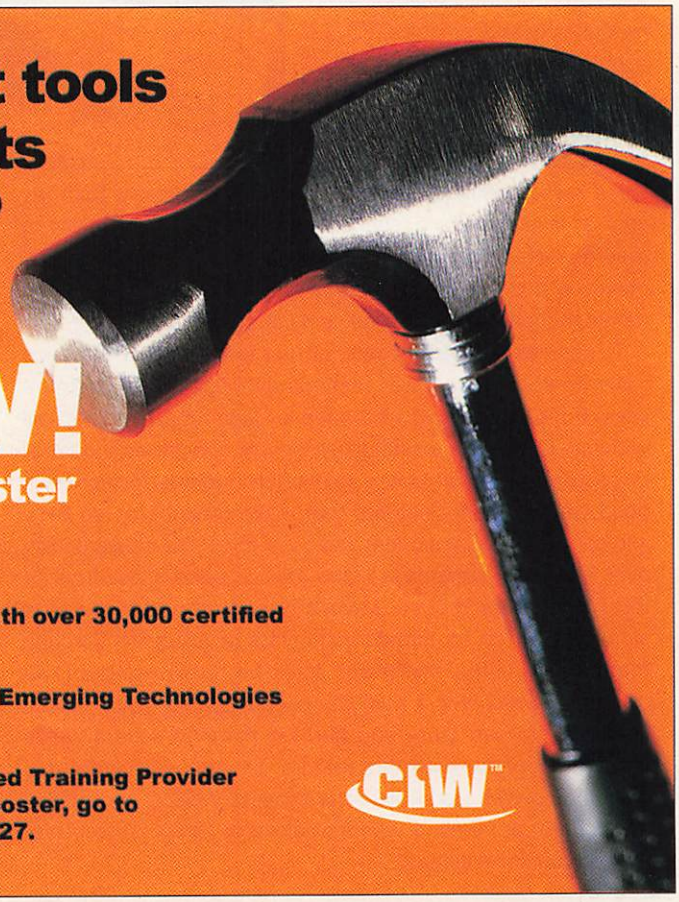

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Pioneer's DVD: Built for Classroom Use

DVD players are quickly becoming standard appliances on college campuses as more and more instructors recognize the versatility of these machines. Unlike a DVD player designed for home entertainment use, the professional-quality DVD player is loaded with features that ensure that it will withstand frequent use and abuse.

The teacher-friendly DVD-V7400 is Pioneer's rugged workhorse for classrooms and lecture hall presentations. Compact and lightweight, it offers a variety of features that make it appropriate for campus use. The 10-lb. unit fits easily onto a small cart, leaving plenty of room for other appliances. All major functions can be accessed via a newly designed wireless remote or optional wired remote. Alternatively, the player's PS2 port allows educators to navigate using a mouse and keyboard plugged directly into the front of the unit. Users can also connect the player to a computer for interactive multimedia presentations.

The DVD-V7400's video blackboard feature works as a highlighting tool. Users can type text, create drawings, or place graphics right on top of the video displayed on the monitor without permanently transferring the highlights to the disk. The player thus becomes an interactive blackboard for spontaneously demonstrating and pointing to specific concepts on the screen.

Pioneer has loaded the player with barcode features designed to facilitate lecture hall use. The optional barcode reader enables teachers and students to scan preprinted barcodes from any print materials accompanying DVD-Video disks. Once scanned, the codes can be used to read images right off the disk. The barcode stack/command stack feature allows users to save video play lists for automatic recall and display. Using this feature, an instructor teaching several sections of the same course can store into memory each day's presentation, saving class preparation time. It is even possible to set the player to play up to 24 different events in one week, all controlled through the weekly on/off timer. This feature makes it easy for an entire department to share one DVD player. Separately available Bar N'Coder Software allows instructors to create and print barcodes for any DVD disc, customizing the disc for individual needs.

The DVD-V7400 plays multiple disc formats, including video CD, CD-DA, DVD-Video, and DVD Hybrid, and multiple disk media, including CD-R, CD-RW, and DVD-R. Other features included in the DVD-V7400 are playback memory (bookmarking function), scan, slow motion, on-screen menu, and chapter preview/digest. The player has component video output terminals, two composite video outputs, S-video connector, and RF output. A headphone jack with volume control is included as well. To ensure its tough reliability, the player features a brushless spindle motor combined with a heat and dust-resistant enclosure. Pioneer guarantees the player with a one-year warranty on parts and labor. It boasts a mean time between failures of 37,000 hours at a 100 percent duty cycle.

For more information on Pioneer's DVD-V7400 player, visit ***www.pioneerelectronics.com.***

Digital Video 101

The basic technology behind the DVD player is essentially the same for every model, because every model is based on the DVD 1.0 standard specification. Every DVD player outputs audio and video to a television, computer, or audio device from a DVD disc, which looks like a compact disc. All players include basic features such as layer switching, subtitles, camera angles, the ability to read multiple languages, and parental controls. Beyond that, however, a multitude of features are available and vary from model to model, affecting cost and performance.

Consumer-oriented models, on the lower end of the price scale, tend to offer fewer features and less robust performance. Education buyers who need a rugged machine that will withstand years of constant use should choose an industrial or professional-level player that offers high-performance, a good warranty, and features that make classroom use easy and convenient. Component video improves the image quality over S-video or composite video. Having ports in the front of the machine for mouse, keyboard, and other attachments simplifies set up for harried instructors or A/V staff. Barcode features are useful classroom tools for those using a DVD disc that comes with a manual or supplemental guide. Some DVD players can store and play on demand several discs (hundreds, even); with this feature, several instructors can share one player, load it with the necessary discs, and display the content as needed without having to restock the player for each person's lecture.

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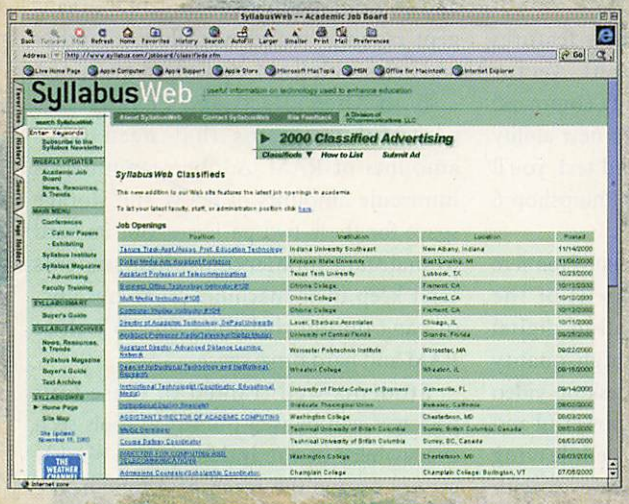

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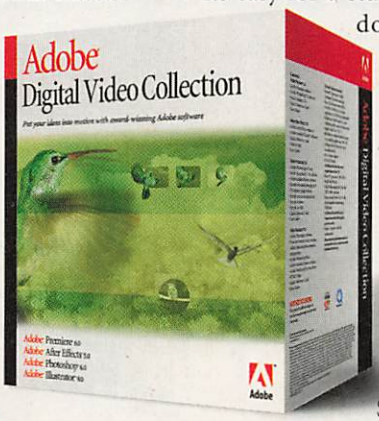
Adobe Digital Video Collection: Cost-effective, Tightly Integrated

Adam Watkins

When choosing software for a digital media curriculum, there are always two major issues to consider: the presence of the software in the industry and user community and how "teachable" the software is. On both counts, Adobe's Digital Video Collection is an attractive package to help students master digital video.

The Digital Video Collection includes four applications, Adobe Illustrator, Photoshop, Premiere and After Effects.



As a group, these four packages' strongest benefit is Adobe's uniform interface. Although there are differences in the interface to match the different functions of each program, once a student becomes familiar with the basic characteristics of the Adobe interface, each succeeding Adobe product is easier to learn. In addition to uniformity of interface, these four packages reap the benefit of being from the same company in other ways, including a fairly seamless exchange of files and maintaining the integrity of layers.

Individually, the packages also have advantages. Illustrator holds the lion's share of today's vector-based illustration market. While its use in creating digital video can certainly be questioned, the value of being fluent in Illustrator cannot be over-stated. If your only focus is on digital video production, you may find Illustrator the most underused application of the package. But if your focus is broader, the inclusion of Illustrator makes this package a economical.

Photoshop is everywhere. Every digital artist, whether a layout artist, Web designer, 3D animator, or video artist, uses this powerful raster tool. With each version of Photoshop comes more power and more versatile features. Unfortunately, this added versatility comes with a price: the days of a sleek image editing application are gone; so are the days of getting by with minimal RAM.

If you're using an older machine with 64Mb of RAM, you probably will be more frustrated than empowered with Photoshop 6. The tools are also becoming so diverse and so deep, teaching Photoshop 6 can feel a bit like trying to teach someone to weed their flowerbed with a bulldozer. Its easy for a student to become bogged down in the myriad options and flexibility of the Photoshop toolset. Plan on spending some time becoming acquainted with this program's dark corners and how to back out of them, because you'll inevitably find your students there.

Still, with new features like resolution-independent vector outputs, the entertaining liquify command (a sort of image putty), and a new ability to effectively manage layers and text, you'll find the added time learning Photoshop 6 has big payoffs.

It would be hard to claim that Premiere (the video editing component of the package) is the end-all-be-all of digital video. As the gap between high-quality broadcast video editing and desktop video editing has narrowed, several powerful and elegant packages have emerged, leaving Premiere to play catch-up. However, with version 6, Premiere comes into its own with the NLDV Firewire revolution. Using any G3 or G4 Mac, or any PC with a Firewire (IEEE 1394) card, Premiere allows for full NTSC video capture. The editing of this DV-compressed video will enable students to work with and output broadcast quality video from the start rather than the traditional 320x240 projects of yesteryear.

Perhaps the most powerful selling point of Premiere is its scalability as a teaching tool. Although Premiere 6 will permit Single-Track editing, it will also allow students to work in the A/B Editing workspace. Students should learn Single-Track eventually, but A/B editing is such an intuitive and visual way to edit that here at the University of the Incarnate Word, we often teach everything that our beginning 3D animation students need to know to assemble their 3D projects in one session. The transitions are easy to understand, timing and sound fall into place easily, and students see immediate success.

After Effects is just plain fun power. True creativity emerges when students get their hands on this compositing package. Although perhaps not the industry cornerstone, it is widely used. It is a great way to get students started in multilevel time-based media. The production bundle comes with robust filters that can be combined in dynamic ways to create a look and feel unique to each student. "Intelligent caching" makes workflow smoother and helps with RAM-challenged machines.

Both After Effects and Premiere are powerful programs that need large amounts of RAM. Adobe recommends miniscule amounts of RAM and storage space for these two packages, but its hard to maintain momentum when students can't keep their machines from crashing, or can't output their files due to lack of RAM and hard drive space.

Students well trained in these four packages will be well trained in tools seen everywhere in the industry. You simply cannot escape the reach of Adobe in the digital media world. If you are working with dated hardware, upgrading to this package may not be the best choice, but with good hardware, and time to explore its new and powerful features, the Digital Video Collection from Adobe is becomes a potent teaching package.

Adam Watkins** is director of Computer Graphic Arts at the University of the Incarnate Word in San Antonio, Texas. **awatkins@cc.usu.edu

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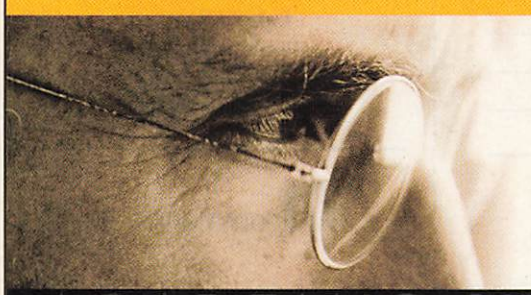

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Syllabus (ISSN 1089-5914) is published monthly by 101communications LLC, 9121 Oakdale Avenue, Ste. 101, Chatsworth, CA 91311. Periodicals postage paid at Chatsworth, CA, and additional mailing offices. Subscription rates: $24/year United States and Canada, $75/year International. **Subscription Inquiries, back issues requests and address changes:** Mail to: *Syllabus,* P.O. Box 2064, Skokie, IL 60076-7963 or call 866-293-9134 for U.S. and Canada, 402-293-9134 for International, fax 847-647-9295. Canada Post International Publication Mail (Canadian Distribution Sales Agreement #IPM40039410). **POSTMASTER:** Send address changes to *Syllabus,* P.O. Box 2064 Skokie, IL 60076. Printed in U.S.A.

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